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INTERNATIONAL FEDERATION OF AUTOMATIC CONTROL

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Honorary Editor of IFAC

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IFAC NEWS

Membership

Although we announced the Yugoslav membership of IFAC in the Information Bulletin No. 6 (page 4), we have not yet given the particulars which are as follows:

23°) YUGOSLAVIA — Yugoslav Committee for Electronics, Telecommunications, Automation and Nuclear Engineering, Terazije 23, Beograd — $ 125

During the IFAC Congress, Moscow, June 1960, three new National Member Organizations have officially joined IFAC, which brings membership to 26. They are:

24°) ARGENTINE — Centro Argentino de Control Automatico, Peru 272, Buenos Aires — $ 250

25°) CANADA — National Research Council of Canada, Ottawa 2, Ontario — $ 250

26°) BULGARIA — Bulgarian National Council of Automatic Control, 12, Narodno Sabranie square, Sofia — $ 125

The following countries have decided to double their annual subscription. The new subscriptions as from 1961 are:

Hungary (beginning already with 1960)	$ 250
India	$ 250
Israel	$ 250
United Kingdom (beginning already with 1960)	$ 500
U.S.A.	$ 2000

THE FIRST INTERNATIONAL CONGRESS OF IFAC

Note from the Editor

The First International Congress of IFAC held in Moscow from June 27 to July 2, 1960 proved to be a very great success.

Some 1500 participants attended, 285 scientific papers were read and thoroughly discussed, and they included most valuable and important contributions to Automatic Control theory, components and applications. The Executive Council, the Advisory Committee and the six Technical Committees of IFAC met, studied problems to be solved, took important decisions and planned future action.

Evidence of the worldwide importance of this event was provided by the attitude of the Government of the host country which was represented, at the opening session, by Vice-Premier A.N. K o s y g y n , First Vice-President of the Council of Ministers of the USSR, and which later gave a reception for all the participants and the ladies at the Kremlin Palace. In the absence of Premier K h r u s c h e v from Moscow, the guests were greeted by Vice-Premier I g n a t o v. A special post-stamp with the initials of IFAC was issued in order to commemorate this very important Congress.

The Proceedings of the Congress will be published early next year by Butterworths Scientific Publications, London, in English language, and by the USSR Academy of Sciences in Russian language. There is of course no question whatsoever of publishing in the restricted space of our Information Bulletin an abstract of any particular paper, since the English version of the preprints of papers submitted to the Congress represented 4 volumes totaling 2098 pages.

However, we wish to give the readers of the present Bulletin a broad picture of what was achieved in Moscow, particularly in the following three respects:

1 - Significant opinions expressed by some prominent scientific and governmental personalities on the importance of Automatic Control and on the part IFAC has already played or should still play in its development.

We hope to achieve this by publishing in-extenso the speeches of President L e t o v , of Past President C h e s t n u t and of Vice-Premier K o s y g y n and the lecture by Academician T r a p e z n i k o v at the Opening Session of the Congress (Chapter I below) as well as the speeches of President L e t o v and of First Vice-President G e r e c k e at its Closing Session (Chapter III below).

2 - Review of the past activities of the six IFAC Technical Committees, decisions taken during their meetings in Moscow and plans established for their future work.

To this end we publish in Chapter II below information obtained from the Chairmen of IFAC Technical Committees on Theory, Components, Applications, Terminology, Bibliography and Education as well as the short report read at the Closing Session of the Congress (Chapter III) by Professor E c k m a n , Chairman of the Advisory Committee, who summarized this information.

3 - General trends and significant contributions to Automatic Control theory, components and applications as they can be summarized from the Congress.

To this end we publish in-extenso, in Chapter III, the final reports respectively read at the Closing Session of the Congress by Academician P e t r o v , Chairman of the Committee on Theory, by Dr. B o r o m i s z a , Chairman of the Committee on Components and by Dr. M o z l e y , Chairman of the Committee on Applications, all based on remarks made by session chairmen in the three main sections into which the Congress was divided. We hope that this will enable readers of our Bulletin to locate problems of particular interest to them which have been dealt with at the Congress more easily.

The preparation of this information on the Congress has taken a good deal of work and time, especially where translation from Russian, French or German into English was required. Although much care was devoted to the latter, we are too well aware of the old Italian proverb: "traduttore - traditore" ("a translator is a traitor"): to omit apologizing in advance to authors of speeches or reports which may have been incorrectly translated.

We should also like to thank for their kind co-operation the National Committee of the USSR for Automatic Control, the leading personalities of IFAC and the Chairmen of IFAC Technical Committees who allowed us to obtain in due time the necessary original information.

Prof. Ing. Dr. Victor BROIDA,
Honorary Editor of IFAC

I. Opening Session, Monday June 27, 1960

SPEECH OF PROFESSOR A.M. L E T O V (USSR)
PRESIDENT OF IFAC

I have some difficulty in expressing the extent of my pleasure in having this opportunity to greet you at the opening of the present Congress.

As President of IFAC, I am glad that representatives of 29 countries are attending this Congress in order to discuss some of the most important and interesting problems of science and of engineering.

As a citizen of the USSR, I am glad that the first Congress in the history of IFAC takes place in Moscow.

Let me thank on the behalf of IFAC, the Soviet Government and the Moscow City Soviet for having given us, scientists and engineers, the possibility of meeting here.

We well understand that without Automatic Control modern society is unable to solve the problem of covering the material needs of its increasing population. IFAC as a whole and particularly the present Congress will co-operate in the solution of this most important problem, since they provide excellent opportunities for the establishment of scientific contacts and for the exchange of scientific information. For nearly three years we have awaited this day and have been thoroughly preparing for it. This preparation started at the moment when the First General Assembly of IFAC in Paris decided to hold the first IFAC Congress in Moscow in 1960. Now this preparation is complete to a large extent as a result of the great efforts of the National Committee of the USSR for Automatic Control.

On behalf of IFAC, I should like to thank the Soviet National Committee for this work. The preparation of the Congress has been carried out with the active co-operation of the National Member Organizations of IFAC, of the members of the Executive Council, of the Advisory Committee and of the Technical Committees, of the Honorary Secretary and of the Honorary Editor of IFAC. To all of them I should also like to express my sincere gratitude for their co-operation with the Soviet National Committee.

The day has come when we can practically bring into effect within the framework of IFAC our mutual desire to establish scientific contacts one with another and I should like to congratulate all the participants of the Congress heartily on the advent of this day.

SPEECH OF MR. HAROLD CHESTNUT (USA)
PAST PRESIDENT OF IFAC

As first President of IFAC, I want to thank the National Committee of the Union of Soviet Socialist Republics for Automatic Control for its fine handling of this First IFAC Congress.

When the idea of holding an International Congress was in its early stages in 1957, Professor L e t o v , acting on behalf of the National Committee of the USSR for Automatic Control, graciously invited IFAC to hold this Congress here in Russia. The General Assembly accepted this kind invitation.

During the intervening time, the Executive Council has had reports of the progress being made for this Congress. The general organization and arrangements have served to set a well thought-out plan of operation. The courtesy and genuine hospitality of our host Professor T r a p e z n i k o v , Professor L e t o v and others of the organizing committee have served to provide an excellent opportunity for a healthy exchange of information and ideas on the subject of automatic control among the many hundreds of experts from more than 2o countries of the world.

Among the many opportunities which face us are:
- Specific sessions on theory, components, applications.
- Meetings of IFAC Technical Committees.
- Visits of technical, scientific, and cultural interest.

This is a great challenge to us, for we have unparalleled opportunities to meet people we have known only through their writings - and others whom we have not even heard of but who nevertheless have made outstanding contributions to automatic control. Let me encourage you to introduce yourself to others and make the most of this occasion. Participate actively in the discussions to make the technical sessions most effective.

On my way over here I had an opportunity to visit a number of countries and talk with friends working on automatic control. Everywhere scientists had more problems than they had people to work on these problems. I think this is probably true of countries I didn't visit too. Some of the answers, or ideas to make getting the answers easier, may already be known to people in this room. I hope that each of us can find the answers for some of our problems.

In each of the countries I visited, the people are asking their industry to increase its output, to accelerate the improvements in their housing, appliances, and transportation. We engineers and scientists working on automatic control have an important responsibility to do our part to make these improvements take place more quickly.

From the new concepts of non-linear control, adaptive control, optimizing control, computer control, and many others we should be able to synthesize and analyze automatic controls better.

With new solid state control devices and other improved components we have new and better parts with which to work.

With improved computing devices and other information conversion equipment available to us, we have new tools to build these better automatic controls. We must strive always to make these controls more reliable and, to the extent possible, cheaper. We are now controlling and talking about controlling much more energy and material than in the past. We must do this safely and economically.

Many other scientists and engineers are developing new energy conversion equipments, new materials conversion processes, and new information conversion schemes. Working with them, we have many new and challenging applications in which to incorporate automatic control.

All of our countries and the other countries in the world are looking for new and better ways of improving the standard of living and improving the lot of mankind. Automatic control is one of the more important methods of making this possible and relieving man of drudgery and hardship. If each of us can learn of at least two or three new ideas during this meeting, we will have provided a sound economic justification for this gathering. If we each can get to know two or three new people from another country, skilled in our fields of interest with whom we may correspond and exchange ideas, again it will make this meeting worthwhile.

Let us make the most of these fine opportunities. Let us provide a sound basis for future IFAC Congresses on Automatic Control in the years to come.

SPEECH OF VICE-PREMIER A.N. KOSYGYN
FIRST VICE-PRESIDENT OF THE COUNCIL OF MINISTERS OF THE USSR

Let me greet on the behalf of the Government of the USSR the delegates and guests of the First International Congress of Automatic Control.

Quite recently, only 20 - 30 years ago, Automatic Control was considered as just one of the many means for developing technological processes, having only a limited, partial importance. Even the words "Automatic Control", "Automatization" did not appear at that time on the pages of the world press, with the exception of Soviet press, but in the early forties the position utterly changed. Automatic Control is now recognized throughout the world as a new, young, independent branch of science and engineering, as one of the most powerful levers of modern technical progress. More than that, Automatic Control enters the world's arena and takes by right, on account of its importance, an equal place in the field of science with new techniques such as nuclear energy, radio-electronics and astronautics. This can be explained by the enormous possibilities provided by Automatic Control for the development of modern techniques. Complex mechanization of production by releasing man from heavy physical labour and replacing his work by that of mechanisms and machines increased productivity and prepared the ground for the following higher stage - the complex automatisation of production. Complex automatisation of production already releases men from control operations, pertaining to the field of intellectual brain work. Modern automata are able to relieve men in many instances from brain activity and therefore enable him to economize his forces for the creative process.

Automatisation leads to a further fundamental increase of productivity and allows man to bring into effect processes characterised by high speeds and intensities which were unattainable before on account of the limitations of human nature. However not only quantities should be considered. Complex Automatisation results already in important social, economical and political factors. Automatisation, by increasing productivity, contributes to a marked increase of material wealth and to a solution of the problem of a substantial increase in the standard of living of mankind. Automatisation contributes to the obliteration of the frontiers separating brain work from physical labour, creating a basis for an unusual cultural flowering and an increase of the intellectual level of the average man. Concern is sometimes expressed that by releasing an important amount of labour, Automatic Control would lead to a decrease of occupation and to serious difficulties connected with redistribution of manpower amongst various branches of

production as well as amongst various territories. Some experts and politicians believe that behind these consequences of automatisation are already outlined two threatening shadows, those of overproduction and of unemployment. But abundance cannot be an evil if production and distribution and all the economic, cultural and social life of society are built on a well-organized planned basis and managed according to a peaceful direction. This is why we, Soviet people, as well as people of other countries having reasonably-organized economies, do not fear the consequences of automatisation and do our best to develop it strongly.

It is very significant that the first International Congress of Automatic Control takes place in the USSR, a country which successfully develops automatisation of production, a country in which automatisation is accomplished as a state policy. It is not accidental that in the USSR, for the first time in the world, the review "Avtomatika i Telemechanika", specially devoted to this field of science, was first published in 1936, and that we have created, also for the first time in the world, in 1939, under the leadership of the Academy of Sciences of the USSR, a special Institute of Automatics and Telemechanics, one of the most active organizers of the present Congress.

Let me express the certainty that this Congress will contribute to a fruitful exchange of experience between scientists and engineers of various countries, to the establishment of friendly contacts between them and to a further peaceful development of industry, of energy production, of transportation and of all features of the life of mankind.

Let me wish you successful and fruitful work and express the hope that your stay in the Soviet Union will be useful and interesting.

After the speech of Vice-Premier K o s y g y n , greetings to the Congress were delivered by Academician A.N. N e s m e y - a n o v , Chairman of the Academy of Sciences of the USSR, by Professor Rufus O l d e n b u r g e r (USA), by Professor H u - T c h e n - W e n (China) and by Professor Ed. G e r e c k e (Switzerland). Then Academician V.A. T r a p e z n i k o v , Chairman of the USSR National Committee for Automatic Control, delivered a lecture on the following subject:

AUTOMATION AND MANKIND

by Academician V.A. TRAPEZNIKOV (USSR)

This Congress has been convened to discuss problems of automatic control or - more widely - of automation.

It is pertinent to ask what the overall goal of automation is. What can automation give humanity ? Before we can answer this question, let us picture to ourselves the likely fruits of automation and trace the effect of automation on man in the foreseeable future.

First and foremost, automation spells a steep rise in labour productivity. Of course, automation is by no means the only factor contributing to scientific and technological progress which results in higher labour productivity and expanded production of the good things of life. A big role here will be played by advances in controlled fusion, synthesis of man-made organic substances including foods, and in the multitude of other sciences and branches of technology. However, all departments of knowledge today are knitted together closer than ever before, and their further headway is inconceivable without automation. To cite but a few examples, man owes to automation his space progress, photographs of the Moon's reverse side, and the very existence of powerful means of research like the proton synchrotron.

But automation is still an infant. It will rise to maturity in the life-span of generations to come. What we can therefore do now is to outline its benefits for man in general terms only.

Automation will bring in its wake a big leap in productivity not only because man will not have to operate machines by hand and a single operator will be able to attend to many automatic units at a time. What is more important is that the expansion of production will no longer be constrained by the human factor in process control.

In many cases today, the rate of industrial processes is restricted by the potentialities of control. Man's response to environmental changes is rather slow. This is why we can only use slow processes.

Automation will revolutionize the majority of manufacturing techniques, as it will provide for control of industrial processes which occur at extremely high rates and on a large scale. While our practice to date has been confined to stable processes, automatic control will place unstable processes at man's disposal as well. Man will be able to control both the outcome and kinematics of reactions.

Atomic energy is but one example of how an effective control system has enabled man to utilize extremely dangerous phenomena to the best advantage. With absolute confidence in automatic instrumentation, it will be possible to maintain processes as close as possible to critical operating conditions. As a result, use will be made of the processes which seem to be beyond man's control today.

The goals of automation can only be achieved when all steps of the industrial process have been automated in all basic industries, transport, and building, including the assembly, adjustment, inspection, shipment and distribution of the finished product, that is, when comprehensive automation has been realized to cover ramified remote control systems widely using computers.

It stands to reason man cannot possibly be excluded from this process entirely. Supervision, maintenance, research and development will always call for his more or less regular attendance. It is beyond any shadow of doubt that man's potentialities in the field of control are great indeed and will never, it appears, be fully surpassed by machines. Therefore, it is the foremost and noble task of scientists in the field of automatic control theory, physiology, psychology and technology to find the best possible uses for man in control systems and to create the best possible conditions for man's activity in process control.

Not only will automation raise productivity, but it will also radically change the very nature of labour. Already now a number of arduous and hazardous occupations have almost completely been done away with, and the trend will continue. In many cases you can no longer see the stocker doing his exhausting job, while those of the steelmaker and blast-furnace operator have become appreciably easier to do. Looking further out into the future, automation will completely take over jobs involving elevated temperatures and pressures, contaminated or harmful atmospheres. Automation will help turn manual labour more and more into mental work, thus removing the difference between them, so that man's energy and vital strength directly involved in production may be utilized to an ever greater degree not for process control or - less so - for manual labour, but to produce and realize novel engineering ideas, such as would further relieve man of direct participation in production and would give him abundant life and more leisure.

The higher labour productivity and expanded material production stimulated by automation will sharply improve the standards of living and reduce the working day to but a few hours in the near future.

The full utilization of the benefits arising out of automation, however, is only possible in a rationally organized society where the manpower made redundant due to automation in one field is easily absorbed in others. Our firm conviction - which we do not, of course, impose on anybody - is that this possibility is offered by the socialist system.

With increasingly more material benefits available due to automation, a smaller proportion of people will be needed in production. A larger number of them will be concerned with research and development, public health and the arts, making our communities better places to live in by laying out parks and gardens, decorating public buildings and so on.

With more leisure time, means and possibilities at his disposal, man will be able - for the first time in history - to devote to himself the attention he rightly deserves. An era will set in of scientific approach to human health, with emphasis on balanced daily regimen and diet, sports and prophylaxis. Medical and biological sciences will be given priority to the point where the main duty of the physician will be that of prophylaxis and every case of desease will be regarded as an emergency. Automation's important contribution to medicine will be automatic and semi-automatic apparatus to watch the patient's health, keep his case history, diagnose and treat his ailments.

Automation opens up vast vistas before science. The spectacular break through into outer space is the case in point. Indeed, progress in automation is a decisive factor in manned space travel which, I believe, this generation will live to see. In turn, the breakthrough into space is bringing about rapid headway in our knowledge of many crucial problems which have been challenging men of science for centuries. The origin of life, extra-terrestrial life, the fate of the Earth as a planet - all these and other problems which have always been in the mind of man are approaching their solution thanks to space research and, hence, to automation.

Mention should also be made of biology - or more specifically - of control in living organisms. These problems closely relate to that of the origin of life. Automation will undoubtedly speed up their research. In turn, automatic control systems stand to benefit much by investigations into living beings.

Automation is changing the forms and techniques of research in many departments of science and technology. The very process of cognition is being speeded up. Our knowledge is growing in a kind of chain reaction. The more we learn, the wider the horizons and prospects in front of us, the ampler opportunities for further progress of research, discoveries and knowledge. This, however, poses further difficulties.

For one thing, it is becoming increasingly difficult to store the huge wealth of information and to transmit it in concise, condensed form. On the other hand, it is becoming increasingly difficult to glean new data, to carry on new studies, as science is ramifying at a high pace. Whatever we look at - numerous experiments on alternative chemical reactions made to find unknown properties of chemical substances; studies into the living cell; investigations into conditioned reflexes; research into economic and other complex problems - all this takes a heavy toll of human effort, and of skilled effort, for that matter. In the future, human work will be substantially supplemented and partially supplanted by automatic machines. Automatic systems with minimun a priori information put into them by the designer will collect information in new fields of knowledge. Already now the researcher is equipped with a variety of measuring, recording, and computing machines. In the future a veritable research industry will emerge, based on specialization, co-operation, and use of machines.

The automatic machines helping the investigator can be self-learning. They may learn simple skills for limited assignments. In fact, it is not impossible in principle to make them acquire a kind of "creative" skills, that is improve automatically their performance in complex fields. Today, no limits can be forecast for the development of such systems. It is not in the least unlikely that an automatic machine may be designed which will be able to work out comprehensive theories explainings experimental information in any field by testing various hypotheses and drawing upon empirical knowledge. And this is what we call today truly creative activity !

This faculty, of course, belongs not to the automatic machine, but to man who has designed it. You cannot possibly conceive of an automatic machine divorced from man. Any machine, including automatic, is but the brainchild of man. But it can help man in his brainwork by extending and raising it to a level which defies our imagination.

Electronic computers have shown how far man can rely on them for the performance of operations based on formal logic. Indeed, it has been a kind of revelation for specialists to find out how wide the field of formal logic extends and how complex the processes are which hitherto were the domain of the human brain, but which now lend themselves to automation with the advent of digital machines.

Machine translation and programming of problems which would seem to belong to the human brain, such as chess problems, have convinced many that formal logic, that is, thinking

which can be programmed, is much wider in scope and plays a far bigger role than it was customary to believe. Where do the limits of such possibilities lie? How wide is the field of brainwork which can be handled by automatic machines? Is this field limited to processes which can be reduced to an algorithm, or does it extend far beyond? We take an optimistic view of such things and hope that automation holds an unlimited promise as a helper of man in his mental activity. In effect, automation plays a noble role here, for it is relieving the human brain of routine work on an ever larger scale to offer man inexhaustible opportunities for creation and aesthetic endeavours.

The goal of automation is a noble one. It is realistic and feasible. But there is a number of obstacles to clear and a number of formidable problems to solve before it can be achieved.

For all big strides in the individual departments of automatic control theory, the overall picture of the theoretical aspect leaves much to be desired. For one thing, there exist a multitude of isolated theories not integrated into a single comprehensive theoretical structure. The all-embracing fundamental ideas, methods, concepts and laws are still in the making. Secondly, a number of conceptual problems have not been studied at all. Gaps in control theory are particularly striking when attempts are made to study complex systems with abundant elements and relationships between them. In fact, the very approach to such problems is not yet clear. On the other hand, it is such systems that are most promising, for they simulate certain complex functions of man.

It should be noted further that the theory of automatic control is gradually changing its nature. It is rising to the status of the key factor in automation. While in the recent past the theory was primarily incidental to automatic control engineering, at present it is, and will be in the future, assigned an ever bigger role. Indeed, the theory shapes the scientific outlook of the engineer and guides him in search of fundamentally novel systems. On an ever larger scale the theory is being employed for "strategic reconnaissance" so as to find out what machines can or cannot do and how their potentialities can possibly be extended.

Let us dwell on a few major scientific and engineering problems facing automation at the present stage of development.

1. We cannot possibly underestimate the importance attached to the study of optimal control techniques and to the synthesis of control structures approaching optimal.

This range of problems is extremely wide. Indeed, the controlled plant can be either linear or non-linear, with

lumped and distributed characteristics, continuous-time and discrete-time. Performance criteria can also be as diverse in different cases. Systems can be optimal for settling time, for steady state accuracy, for average productivity, for efficiency, for power consumption, for material consumption, and the like.

There exist, at present, general variational principles, such as the maximum principle and dynamic programming, which may provide a basis for the solution of very complex problems. But, not all of these principles are generalized for other important cases. Moreover, their application to actual problems calls for the solution of further complex theoretical problems. Little headway has as yet been made in the synthesis of simple systems approaching optimal. In short, there is much room for progress here.

2. As important is to study the principles underlying the synthesis of adaptive and self-learning systems.

The addition to control systems of sophisticated logic and memory elements has made it possible to handle a far wider range of control problems. These problems involve the establishment and maintenance of the best possible performance of the plant, the gradual development in controllers of the desired responses to complex varying situations, etc.

Much progress has already been made in this field, We in the Soviet Union have developed optimal controllers and multivariable optimizers for both commercial and laboratory applications. Substantial progress has been made in the design of self-learning automata. These are but initial efforts in an important domain.

The study of principles involved in the design of automatic systems which handle such problems, as well as their theory and calculation are among the most urgent tasks facing automatic control theory.

3. It is also essential to study the principles governing the design of automatic machines which supplement or supplant the human design engineer.

It is often the case that man fails to produce the best possible result, if any, when a given design problem involves mechanical structures with a large number of elements. This is where the automatic machine may play a key role. Unfortunately, the theory covering this field is still in embryo, and there is even lack of understanding of relevant design principles. Perhaps, much support here may come from cooperation with physiologists and psychologists and from studies into the manner man handles similar problems. Though rather inaccurate and slow, these methods are remarkable - compared to the existing automatic machines - for

flexibility and adaptability to most varying problems for their "intuition", "imagination" and the faculty of analogy and generalization. It is in this field that automatic control theory comes closest to cybernetics of which it is, strictly speaking, the engineering branch. The possible theory in the new and intriguing field of complex automata may crystallize into a unique alloy of theoretical logic, statistics and perhaps calculus of variations. It is not unlikely that entirely new approaches will emerge to the treatment and solution of problems. Our duty is to speed up progress in these directions in every possible way.

In the Soviet Union, there is a large number of investigators working in this field. A whole range of devices has been developed for the automatic synthesis of optimal control systems, as well as a machine for relay system analysis. The ever-first machine has been engineered for the structural synthesis of relay elements, a machine which starts from the set conditions to produce the structure of a given relay element on an illuminated screen in graphic form. Work is nearing its completion on a machine which will minimize Bulean functions. However, these are but the first steps towards complete automation of control system synthesis.

It stands to reason the directions mentioned above do not exhaust possible trends. For we are faced with a number of other urgent problems - stability, control performance, decisions problems, integrated system theory, etc. There is a strong interdependence between them all, an interdependence which is to grow stronger in the future. As our problems grow in complexity, closer ties have to be built between automatic control theory and other sciences. Mention has already been made of cooperation with physiology and psychology. Ties should also be noted with mathematics, especially with theoretical logic, variational and statistical methods. Other more recently developed mathematical departments, such as functional analysis, may also find essential applications in the theory of automatic control.

Advances in engineering and science are laying a single theoretical foundation for the whole range of engineering subjects involved in communication and control : automatic and remote control, radio and electronics with all their ramifications, computer engineering, etc. This comprehensive theory which is still in the making is often called either communication and control theory, or control theory, or engineering cybernetics. However, the name is not essential. What is important is the crystallization of fundamental ideas, principles and methods. The development of this single theory is vital to automation.

No progress of automatic control theory and engineering, however, is possible without commensurate advances in automation hardware. It has always been that every new device and every new physical principle embodied in its structure has given rise to quantitative changes, to further headway of automatic control theory. This can be exemplified by the impact the advent of electronic computers, both analogue and digital, has had on automation and automatic control theory.

In the field of automation hardware, there are both considerable achievments and numerous gaps - problems which are still waiting for their solution.

The most important among them is that of reliability. For, as the range and complexity of problems handled by automatic control devices increase, an ever larger number of elements have to be incorporated in a given control system, which fact raises the failure expectance rate. Add to this the continuous intensification and growing scale of processes as well as the outcome of possible breakdown, and you will clearly see that the problem of reliability is a key one. In fact, it poses before automation the Hamletian question - to be or not to be. Two approaches are possible to this problem: by developing more reliable components and improved techniques for their combination; and by seeking methods which would allow unreliable components to be integrated into reliable systems.

Another crucial problem in the field of automation hardware is that of unitized control systems which are made up of standardized units which can be combined into various packages suitable for a given plant. This technique simplifies the design, manufacture and operation of automatic control systems and reduces the overall cost of automation.

And last but not least, there is a third important problem in the field of automation hardware. What we have in mind is microminiaturization, that is the development of microelements. This problem has been brought to life by the increasing number of elements in control systems and by the reliability requirements.

This trend is aptly exemplified by digital electronic computers. Huge mathematical machines using thousands of electronic tubes are giving way to machines based on semiconductors and magnetic elements. But the new stage is by no means the final one. Already now there is strong indication of the imminent changes. The new types of computers may be based on novel physical principles. Their components will be magnetic tapes, cryogenic devices, etc. Some of them will be able to perform operations within a few nanoseconds and will

be very compact in size. It is quite feasible to develop a micromodule which will hold many thousands of memory elements in one cubic centimetre. The new elements will be extremely reliable, partly due to new manufacturing techniques, partly due to novel packaging procedures. Among them are films deposited in vacuum, printed circuits for connections inside and between units, etc. The progress made in this field is particularly striking in the Western countries.

It may also happen that the traditional automatic elements will appear in new capacities. Incidentally, as some Soviet investigators have found - quite unexpectedly - the conventional pneumatic devices can be integrated into entirely novel control systems which depend for their operation on the interaction of air jets. They allow a wide range of control systems to be constructed, including high-speed extremely reliable digital computers for process control. This trend, it appears, will revolutionize the design of many automatic control systems.

There is another important problem which unfortunately is outside the scope of this Congress, though it has a decisive effect on automation. This is the study of industrial processes, basic process equipment and automatic control systems taken as an integral whole. As we believe, it is only this approach that can provide for a qualitative jump in the efficiency of automated installation or plant. It is only this approach that allows all the advantages of automation to be utilized to the utmost. We in the Soviet Union have taken this road.

In conclusion, I'd like to touch - if only in passing - upon the planning of scientific effort and research. Of course, the optimal decision problem as applied to the planning of research and engineering does not and cannot have a hard and fast solution. However, what experience is gained in the field makes it possible - in general terms - to solve the key problem - that of correlation between applied research subordinated to the interests of the present day, and fundamental research which deals with the major problems of the future. It is absolutely clear that the role of fundemental or basic research is bound to grow with time, and its scope should be extended. This is the prerequisite for the true progress of science and engineering. On the other hand, the wider the scope and the bigger the role of fundamental research, the more difficult it is to organize it. How can we possibly exclude cases when the investigator takes a byroad for the highway only to find himself in a blind alley? How can we possibly reduce the drain of effort and time involved in trials and errors in a multitude of unknown domains? Leaving

out other considerations, it may be said that much will depend here on contacts and the exchange of information between scientists and engineers in various fields and various countries. The closer their cooperation, the smaller the drain of effort on hopeless projects, the clearer the outline of the major trends, and the steadier the progress along these highways of research. This is what I call for, speaking here on the remarkable day which opens the First Congress of the International Federation of Automatic Control.

The prospects of progress before humanity are imposing. And advances in automation and automatic control theory are part of the general progress. The avalanche-like and ever-accelerating headway of mankind can only be impeded by the monstrous and insensate catastrophe - war. We are confident that this catastrophe will not break out, for the nations will avert it. Peace is the vital prerequisite for the prosperity of man, for the development of science, for the progress of automation.

II. Past Activities, Present Decisions and Programme of Future Action of the six IFAC Technical Commitees

1°) - IFAC TECHNICAL COMMITTEE ON THEORY

a) Membership of the Committee

Chairman: Academician PETROV (USSR)
Vice-Chairman: Mr. LOEB (France)

Members:

Dr. CERNUSCHI (Argentine)	Prof.GONZALES-DOMINGUEZ (Argent.)
Dr. BUKOVICS (Austria)	Prof. CHARLES (Belgium)
Dr. MILSUM (Canada)	Dr. TU SHANG-CHEN (China)
Dr. BENES (Czechoslovakia)	Mr. BLOMBERG (Finland)
Prof. GILLE (France)	Prof. PELEGRIN (France)
Dr. KROCHMANN (Germany)	Dr. REISSIG (Germany)
Dr. SARTORIUS (Germany)	Dr. CSAKI (Hungary)
Mr. SAMPATH (India)	Dr. LEPSCHY (Italy)
Prof. SAWARAGI (Japan)	Prof. BALCHEN (Norway)
Dr. FINDEISEN (Poland)	Dr. KULIKOWSKI (Poland)
Mr. WEGRZYN (Poland)	Prof. SZPARKOWSKI (Poland)
Prof. PENESCU (Roumania)	Prof. MOISIL (Roumania)
Mr. POPOV (Roumania)	Dr. PUN (Switzerland)
Dr. WESTCOTT (United Kingdom)	Prof. TRUXAL (USA)

Prof. VORONOV (USSR)	Dr. PUGACHEV (USSR)
Prof. TSYPKIN (USSR)	Mr. NAUMOV (USSR)
Mr. KOKOTOVIC (Yugoslavia)	Mr. CERNELC (Yugoslavia)

b) Decisions of the Committee

b_1) Decision on the set-up of the COMMITTEE

I. The Committee shall include the following subcommittees:

1) subcommittee on theory of continuous systems;
2) subcommittee on theory of discrete systems;
3) subcommittee on theory of optimal and adaptive systems;
4) subcommittee on algebraic theory of switching circuits and finite automata.

II. The Committee requests all its subcommittees to work in close cooperation and liaison.

b_2) Decision on the preparation of survey of modern Automatic Control Theory.

1) The Committee considers it advisable that a survey of the development of automatic control theory in recent years be compiled.
2) The Committee requests national member organisations of IFAC and members of the Committee on theory to prepare by December 1960 surveys of the development of automatic control theory in their countries in recent years with annotated bibliographies.
3) The surveys submitted by member organizations will be mimeographed and distributed to members of the Committee on theory for consideration and comment.
4) On the basis of the surveys submitted by national organizations the Committee considers it desirable to prepare for publication in several languages a survey of the development of the basic problems of automatic control theory.

   The Committee requests IFAC national member organizations to consider the possibility of their participation in the preparation and publication of the survey.
5) The Committee requests the steering bodies of IFAC to cooperate in the realization of these decisions, and also to assist the subcommittees of the Technical Committee in their activities.

c) The Program of Work of the Committee for 1960-1961

The IFAC Committee on theory has decided to approve the following program:

1) Participation in preparation for the 2nd International IFAC Congress on automatic control in 1963, in Switzerland.
2) The Committee considers it advisable to organize in the period between the Congresses in 1961-1962 international symposia on major problems of modern automatic control theory.

   The Committee recommends IFAC national organizations to consider the possibilities of holding the following symposia in 1961-1962:

   a) Symposium on adaptive and optimum control systems;
   b) Symposium on algebraic theory of switching circuits and finite automata.
3) Compilation and preparations for the publication of the survey of modern control theory (see corresponding decision).
4) Organization of the exchange of information on books published or to be published in various countries, and also of papers and articles on automatic control theory and related problems.

The Committee has tentatively set February 1961 as the time of its next session to be held in conjunction with a session of the Advisory Committee or of another IFAC body.

2°) - IFAC TECHNICAL COMMITTEE ON COMPONENTS

a) Membership of the Committee

Chairman: Mr. BOROMISZA (Hungary)
Vice-Chairman: Prof. OSHIMA (Japan)

Members:

Mr. MULLER (Austria)	Mr. AJNBINDER (Belgium)
Dr. TANNER (Canada)	Mr. HIETALA (Finland)
Mr. JARLETON (France)	Dr. ALTENHEIM (Germany)
Mr. BRITALL (Germany)	Mr. SAMPATH (India)
Prof. BAROZZI (Italy)	Mr. HOLBERG (Norway)
Prof. PENESCU (Roumania)	Mr. PAPADACHE (Roumania)
Mr. CARLISLE (United Kingdom)	Mr. POMPBELL (USA)
Dr. SOTSKOV (USSR)	

b) Report of Mr. Gy. BOROMISZA, Chairman of the Committee

1. G e n e r a l i t i e s

The Components Committee has been created in 1959 in Rome where the IFAC Executive Council decided to start work with a small number of Technical Committees.

The first step was to outline work to be done and to organize the membership.

The President of IFAC and the Chairman of the Advisory Committee gave the general directions on which work should proceed. The work to be done has been determined as follows:

1) Preparation of a biannual review of the technical state of art,
2) Preparation or exchange of standards or specifications,
3) The exchange of information of more specialised nature,
4) Organisation of congresses and other special meetings,
5) Preparation of special symbols or terms.

The Honorary Secretary and the Committee Chairman asked the Chairmen of the National Member Organisations - whilst informing them, at the same time, of the above program as well as of the more detailed program given by the Committee Chairman - to nominate members to the Components Committee so that work could be started. These nominations arrived rather slowly, therefore the Committee at present numbers not more than fifteen members.

The first meeting of the Committee took place on June 24, 1960 in Moscow with the following agenda:

1) Chairman's report on Committee work done so far,
2) Status of the field of activity,
   a) discussion of the circulars N° 1 and 2,
   b) general remarks on the papers presented at the Congress in Section 2.
3) Suggestions for further scientific activity of the Committee,
4) Other problems, participation in the IMEKO 1961.

Eight out of fifteen Committee members, and observers from China and Poland participated in the first meeting, at which the following decisions were taken:

1) The suggested notion "component" was accepted,
2) The field of components should be divided into four groups and for this purpose four sub-committees are to be set up,
3) Special attention should be paid to the papers read at the Congress as well as to the discussions on them, for these

will show which particular field should be emphasized in the future,
4) The participation in the International Measurements Conference in 1961 was agreed upon,
5) The Chairman should submit the problems of administration work of the Committee to the Executive Council.

2. Work done so far

The first aim of the working program has been to survey the State of our field, according to the following points of view:

1) to determine which field belongs to the scope of the Committee and how the word "components" is to be understood,
2) to determine those data which characterise a component so that they be useful in the synthesis as well as in the analysis stage of system design,
3) to determine what kinds of measuring methods, processes and instruments are required to measure the characteristics of each component,
4) to determine whether there are, in the countries of the National Member Organizations, any

   a) standards,
   b) recommendations,
   c) approved practices

   for all those items mentioned above.
   The replies of the membership showed that:

   a) the aims were generally approved,
   b) the above scheme has been right,
   c) it is advisable to divide the field of components into four groups, namely:

      1. instruments and devices informing control systems,
      2. components transmitting information,
      3. components designed to process information,
      4. final control elements.

   d) there are but few countries concerned with standards,
   e) it seems to be desirable to prepare a uniform terminology in the field of activity of IFAC and in this work the Components Committee wishes to take part too.

3. Further Aims

a) The field must be devided into four groups and membership completed accordingly, as required. Following the general viewpoints already outlined, each member will work out the fields of one group, assisted by a small national sub-

committee established by himself and working within the frame of the National Member Organization.

b) One aim of the Committee is to prepare recommendations or to propose standards. Regarding the field it seems to be premature to draft norms and it will be some years before such proposals can be made. The same can also be said of recommendations but here the situation is somewhat easier.

c) The Committee intends to have meetings of its own between two IFAC Congresses in order to gain a better survey of its whole field. - There is one occasion to meet, i.e. at the International Measurements Conference (IMEKO) in 1961 where an IFAC Section is planned to discuss border questions between measurement and control techniques. The following program is proposed:

1. Static and dynamic characteristics of transducers and other components,
2. Trends of development of transducers, with special reference to control application of
   2.1 new measuring methods
   2.2 computers
3. Problems of unification of transducer construction (modular design), input and output characteristics, etc.

About 2o papers are planned to be read in this Section and a special Committee meeting is going to be organized too.

d) Now and again, the Committee will inform the membership of its activity. This mutual information seems to be necessary because it is difficult to participate in the meetings of every National Member Organization as distances are too great, but the members can inform each other of the results obtained.

4. Organization of Committee Work

Administration is carried out by a small Secretariat established in Hungary. Relations, of course, are maintained by means of correspondence. It is desirable to continue this kind of contact.

The Committee Meeting charged the Chairman to submit the following problem to the Executive Council: Our Committee work is growing and becomes more and more active. At present, the Committee works with a small Secretariat of its own carrying out administration work. It would seem to be advisable to have administration work done centrally by the IFAC Secretariat. In this case, of course, the IFAC Secretariat, should be, if necessary, augmented by additional staff.

Summing up: one year's work of the Components Committee is characterised by its establishment, the completion of membership, the outlining of Committee work and the start of our active work.

3°) - IFAC TECHNICAL COMMITTEE ON APPLICATION

a) Membership of the Committee

Chairman: Dr. MOZLEY (USA)
Vice-Chairman: Dr. STREJC (Czechoslovakia)
Secretary: Dr. NICHOLS (USA)

Members:

Prof. DAVIE (Argentine)	Dr. WILLEMS (Belgium)
Mr. SIDALL (Canada)	Mr. HAKALA (Finland)
Mr. CARDOT (France)	Prof. MCLELLAN (United Kingdom)
Prof. QUACK (Germany)	Dr. STURM (Germany)
Mr. VAMOS (Hungary)	Dr. TERAO (Japan)
Mr. HOIVOLD (Norway)	Mr. YOUNG (United Kingdom)

b) Decisions of the Committee

1) For the future international Congresses of IFAC, guidance and assistance will be given by the Applications Committee in the formulation of the program, the solicitation, and review of applications papers and in the running of the Congress.

2) Full cooperation and assistance will be given to sponsors of other international meetings of more specialized character in order to avoid overlapping and to promote attendance and other support. In this connection, the IFAC Applications Committee will sponsor with IBRA and ASICA, an international seminar on "Applications of Analogue Computation to Automatization in Chemical Processes" to be held in Brussels on November 21 to 23, 1960.

3) The question of holding a meeting of the Applications Committee on the occasion of the IMEKO meeting in Budapest in June, 1961 was discussed and was agreed to, primarily because of the major emphasis of the IMEKO meeting on components rather than applications.

4) Annual summary reports on applications work will be prepared by teams from each member country in the following industrial areas:

1) Astronautical and Aeronautical,
2) Chemical and Petroleum,
3) Electrical,
4) Machine Tool,
5) Metals,
6) Nuclear,
7) Textile,
8) Bio-Medical,
9) Power Generation,
10) Paper & Pulp,
11) Ceramics.

Each Applications Committee member is to obtain the names of representative experts in each of the above areas who would be willing to prepare an annual report concerning the activities in his country in that specific area. It is hoped that these review teams will be formed by August 1960, and that our first annual summary report on the year 1960 would be completed by February 1961.

The Applications Committee passed a resolution to bring to the Advisory Committee the wish to have international clearing house in IFAC for the purpose of circulating notices of technical meetings on applications with the greatest speed. Such a clearing house could also be available for the other Technical Committees.

c) Scope and program of the Committee

1) S c o p e :

To promote the interchange at the international level of technical information concerning the application of automatic control techniques and devices to problems in the areas of science, engineering and industry.

2) S p e c i f i c O b j e c t i v e s :

1) To participate to the fullest extent possible in activities pertinent to automatic control applications for the future international Congresses of IFAC. This participation is to include (a) Guidance and assistance in the formulation of the technical programs on applications, (b) Solicitation of technical papers on applications, (c) Review of technical papers on applications and (d) Sponsorship of symposia on specific subjects ot timely interest in the field of applications.

2) To cooperate with other international technical organizations having overlapping or adjoint interests of an applications nature in promoting international meetings or conferences based upon these common areas of interest. Some examples of other international technical organizations with which these joint meetings might be of value are IMEKO, IAAC and IFIPS (See IFAC Information Bulletin N° 6).

3) To prepare on an annual basis, a report by the Applications Committee summarizing the outstanding literature for the previous year. This brief summary report will be submitted for publication in a technical journal in each country which has a national member organization of IFAC. It is anticipated that the other technical committees of IFAC might issue a similar summary report, so that coordinations between these technical committees and the selected journal in each country would be eminently desirable. The journal "Control Engineering" will publish the Applications Committee Reports

in the U.S.A. through the kind cooperation of W.E. VANNAH, Editor. Also, it is understood that the journal "Avtomatika i Telemechanika" will publish these reports in the U.S.S.R.

In order to expedite the preparation of this Applications Committee report, it is suggested that each Applications Committee member assemble a team of qualified experts from his country to report on an annual basis significant applications developments in the literature of his country, each expert to report briefly on his particular area of interest. One suggested division of areas of interest by industry category is (a) Aeronautical and Astronautical, (b) Chemical and Petroleum, (c) Electrical, (d) Machine Tool, (e) Metals, (f) Nuclear, (g) Textiles, (h) Bio-Medical, (i) Paper and Pulp, (j) Power and (k) Ceramics. It is also suggested that the individual reports obtained be consolidated into a single combined report which would be approved by each applications committee member before publication.

4°) - IFAC TECHNICAL COMMITTEE ON TERMINOLOGY

a) Membership of the Committee

Chairman: Prof. GERECKE (Switzerland)
Vice-Chairman: Mr. MASON (USA)

Members:

Mr. MULLER (Austria)
Dr. STIRLING (Canada)
Dr. OETKER (Germany)
Mr. SOLEY (Hungary)
Mr. THIEME (Poland)
Prof. GAVRILOV (USSR)
Prof. HOFFMANN (Belgium)
Mr. WILFART (France)
Prof. KINDLER (Germany)
Mr. FODDIS (Italy)
Mr. GALIN (Roumania)

b) Decisions of the Committee

The members of the IFAC Technical Committee on Terminology have decided in Moscow to prepare:

1) Concepts and definitions of signal-treating and signal-controlling elements and plants.

2) Concepts and definitions of devices used in controlled and controlling systems.

3) Concepts and definitions in the field of control-systems engineering.

4) Graphic symbols for signalflow diagrams.

5) Graphic symbols for control devices in so far as they do not exist yet.

These definitions have to be given in English, French, German, Italian, Spanish and Russian with the friendly collaboration of the National IFAC Members.

5°) - IFAC TECHNICAL COMMITTEE ON BIBLIOGRAPHY

a) Membership of the Committee

Chairman: Mr. AJNBINDER (Belgium)
Vice-Chairman: ..... (vacant)
Members:

Dr. STIRLING (Canada)
Mr. AALTONEN (Finland)
Mr. FAVEZ (France)
Prof. NOMOTO (Japan)
Mr. NAUMOV (USSR)
Prof. TRNKA (Czechoslavakia)
Prof. BROIDA (France)
Prof. OPPELT (Germany)
Prof. DAMSKER (Roumania)

b) Report of Mr. Max AJNBINDER, Chairman of the Committee

At the meeting of the Advisory Committee Prof. OPPELT, former Chairman of the Bibliography Technical Committee has reported that owing to the work already fulfilled by the UNESCO in co-operation with Prof. BROIDA (publication of a list of books on automatic Control for the Moscow Congress), there seems to exist a possibility of further cooperation between IFAC and UNESCO in the field. The publication of the titles of articles on Automatic Control, appearing in technical periodicals all over the world, could eventually be assumed by UNESCO jointly with the IFAC Bibliography Committee.

A cooperation of this kind could be visualized as follows:

1) - Selection by the National Member Organizations of IFAC of a certain number of technical periodicals in their respective countries according to a standard, sufficiently high to correspond to IFAC status.

2) - Drafting, by the IFAC Bibliography Committee, of a classification system for the selected articles. This system could be based upon that already established by Prof. BROIDA for the selection of books, and could be amended to fit the particular purpose of classifying periodical press articles.

3) - Systematical perusal by UNESCO of the technical periodicals recommended by the IFAC National Member Organizations, selection of articles on Automatic Control, and their classification following the system elaborated by the IFAC Bibliography Committee.

Pending the agreement of IFAC Executive Council, a contact with UNESCO will be established in this respect by the present Chairman of the Bibliography Committee.

6°) - IFAC TECHNICAL COMMITTEE ON EDUCATION

a) Membership of the Committee

Chairman: Prof. MARINO (Italy)
Vice-Chairman: ..... (vacant)

Members:

Dr. D'OMBRAIN (Canada) Mr. RISTANIEMI (Finland)
Mr. LE BLANC (France) Dr. ZELBSTEIN (France)
Prof. KINDLER (Germany) Prof. FUDJII (Japan)
Mr. CONSTANTINESCU (Roumania) Prof.McLELLAN (Un.Kingdom)
Prof. SMITH (USA)

b) Preliminary Report of Prof. Algeri MARINO Chairman of the Committee (read by Prof. Giuseppe EVANGELISTI)

1. General Remarks

For many different reasons the question of what should be the basic lines to follow in the training of automatic control technical personnel constitutes a very complex problem. The following points in particular should be borne in mind:

a) The training of such personnel should be related to the special and often widely differing requirements in each particular country;

b) We are very far to-day from a settled stage and many doubts may arise both as to the selection of the subjects and their precise limits;

c) In particular, there is wide-spread uncertainty as to whether methods and equipment for automatic computation should be included in the general scope of automatic control.

Let us for a moment consider this latter aspect of the problem right now.

In my opinion, at this juncture it would not be convenient, if one was to deal with automatic control, not to take into account the various types of electronic computers since they are so widely spread. In fact, electronic computers very frequently appear as essential components of an automatic chain; anyway, even if we look at them as independent units, they are based on principles and methods which are very close to those of automatic control. To fulfil these requirements either training should cover both automatic control and automatic computation or the concept of automatic control should be extended to include methods and equipment of automatic computation. This is a question which certainly demands to be answered very clearly at the meeting of the Education Committee.

2. Different levels for automatic control training courses

The following considerations refer to the above mentioned extensive conception of automatic control (including automatic computation); should training be based on a narrower conception, it will be easy to leave out some of the subjects.

To select the subjects which should be included in the training of technical personnel better, it would seem advisable to define the different levels of training in view of the present and future situation and within the framework of the science and technology of automatic control.

I would therefore distinguish the following levels:

a) F i r s t - Very extensive and thorough training would be expected of research workers - engineers, physicists, mathematicians - to be employed in the great research laboratories or as high-grade teachers.

Courses at this level should train technical personnel that may be able to design equipment not so much with a view to its production on an industrial scale, but rather with the object of demonstrating all those solutions which technical progress has brought within the range of practical possibilities, I mean personnel which is not supposed to face problems involved in industrial production.

b) S e c o n d - Training at this level should produce experts able to take their place most suitably in the great industrial organizations.

Their courses should not differ greatly from those of the first level except that the more technological and practical subjects would be favoured at the expense of the more purely scientific ones, since the aim at this second level should be above all to produce experts able to convert the prototypes designed in the research laboratories into equipment for production on an industrial scale.

c) T h i r d - This would be for experts not interested in research and design but who would have to consider the problems of selection and utilization of the various types of equipment according to given practical uses.

These experts would have to acquire sufficient knowledge to be able to comprehend the many types of equipment normally produced on an industrial scale; they should actually understand how they work, what they can do, what is their accuracy, and how to operate and maintain them, at the same time bearing in mind financial and economic aspects, with particular reference to obsolescence.

d) F o u r t h - This would be meant to train those experts who must be able to install and set up all the numerous units of which modern automatic chains are composed. These experts should possess a wide knowledge of the composition and operation of the various types of automatic control equipment without, however, being able to design such equipment themselves.

This category of experts should be very useful to the second level of experts and therefore their courses, compared with those at the second level, should dispense with much theory, thus permitting the introduction of courses on practical subjects.

e) F i f t h - This last level should produce experts able to insure the operation and maintenance of the plants. They would have to acquire a fair understanding of the composition and working of the plants, but they would not need to possess any thorough-going scientific and technological preparation.

I should like to stress that I have distinguished the above levels by way of a first attempt on the subject. They must obviously be suited to the requirements of the various countries.

I would add that nearly all the above levels could be subdivided at least once, according to whether it is desired to enhance the aspect of automatic control or that of automatic computation.

In the case of the latter it may also be necessary to make a difference in the training of experts specializing in the mathematical aspect of the various problems and those engaged in designing computers taking advantage of all the latest scientific methods and techniques.

These are questions to face as we go along. What matters now is to decide upon how to make a start.

3. Subjects to teach at the various levels

The following is not meant to be a detailed program of instruction at the various levels set out above. Actually these levels are at present only a first attempt, as we said, to map the field. Moreover, various branches are to be considered for each level. The above question will have to be considered by the Education Committee.

We shall simply deal here with some considerations bearing on the subjects to teach at the first level, should the students master both automatic control and consumption.

The range of this program will probably prove too vast and

complex and call for a split, with the result that we shall get automatic control and computation experts specializing in the mathematical, physical, or engineering side of the job - as the case may be.

This being understood, I would group the subjects relevant to the first level under the following headings:

1) Applied Mathematics,
2) Applied Electronics,
3) Automatic Control,
4) Automatic Computation.

3.1 A p p l i e d M a t h e m a t i c s -

There should be at least three different courses covering subjects grouped under this heading, viz:

a) A first course, dealing with probability, theory, statistical methods, and Boole's algebra.

b) A second course, especially conderned with numerical methods and operational research, including methods to solve the corresponding problems in the various fields of application, using modern electronic computers.

c) A third course, which we could call a course in circuit mathematics (system dynamics), dealing particularly with the analysis of periodical and aperiodical signals, as well as with the response to such signals, of linear and not time-varying networks, linear and time-varying networks, and non-linear and perhaps time-varying networks.

This course should start with complex variable functions theory, conformal mapping and matrix theory. The course should then be completed by a presentation of the chief methods of network synthesis (Chebichev's, Butterworth's and other approximations etc.), the theory of smoothing and filtering, and the elements of information theory.

I should like to emphasize the importance of this third course since it would permit us, before starting on the courses specifically concerned with automatic control, to introduce all the basic notions. I mean all the notions concerning Fourier's transformation, Laplace's transformation, Duhamel's integral, the "Z" transformation, etc.., as well all the notions concerning stability criteria, etc.., so as to render unnecessary any explanations of such topics during the courses in automatic control to the detriment of a full and thorough-going treatment of the various types of automatic chain.

3.2 Applied Electronics -

Turning now to the subjects ranged under the heading Applied Electronics, this group should comprise at least two courses, viz:

a) A first course, furnishing the physical bases of electronics in vacuum and gas-filled tubes, and of solid state electronics, as well as the physical bases with regard to magnetic and dielectric materials;

b) A second course, dealing with electronic tubes, with solid state diodes, and with transistors considered in their external characteristics, as well as with the use of such devices for purposes of detection or rectification, generation of signals of various form, selective and broad-band amplification, as well as electronic and magnetic memory devices, and magnetic and dynamic amplification.

3.3 Automatic Control -

As to the group of subjects ranged under Automatic Control, at least four distinct courses are required, viz:

a) A first course, dealing with the theory of automatic control, with a view to the study of the behaviour of the different systems (system analysis),

b) A second course, dealing with the theory of the design of automatic control systems, once their performance and accuracy have been considered (system synthesis).

c) A third course, dealing with the strictly technical problems of automatic control systems.

d) A fourth course, dealing with the components of automatic control systems.

As regards the above courses, I on purpose refrained from a discussion of the programs but I do want to stress that the courses should come up to modern requirements and develop, on the level of practical applications of automatic control, all the problems that were considered in the circuit mathematics course. They should, therefore, deal with linear systems, sampled data systems, non-linear systems, and adaptive systems, as well as with those questions connected with the methods of statistical investigations and those connected with multi-input systems. Furthermore, greater importance than is usual to-day should be given to the study of sequential control systems.

3.4 Automatic Computation -

Finally, passing to the group of subjects gathered under Automatic Computation, there should be at least three courses, viz:

a) A first course, about digital computers.

b) A second course, about analog and other special computers.

c) A third course, dealing with data processing and programming of digital computers.

4. Conclusions

The object of the foregoing considerations is merely to call attention to some important questions which should be within the range of the Education Committee's future activities.

In order to be able to draw up a programm, it would be helpful if some principles could be established and, in particular, it would be appreciated if members of the Education Committee would care to pronounce themselves on the following points:

1) Whether or not methods and equipment used in automatic computation should be included in the training of automatic control experts, and, in the affirmative, whether it is considered that this should pass under the name of "automatic control" used in a wide sense or whether adoption of the name "automatic control and computation" is preferred.

2) Whether it is considered that in the training a certain number of levels should be determined and, if so, by what criteria they should be distinguished.

3) Whether, admitting such graduation, it is considered that groups of subjects to form the basis of instruction of each level should be determined or not.

4) Whether, if so, it is considered that the chief subjects at each level should be determined and, moreover, the problems to be treated within each subject should be broadly indicated.

5) Whether it is considered desirable to include in the questions to be dealt with the problem of how to organize the training, so that common features could emerge which might prove useful in the practical realization of the courses.

6) Whether or not anyway, in organizing the courses, specialization should be carried very far - since this is a question of great consequence to the character which the various levels of training and their subdivisions will assume.

As to the organization of the Education Committee, nothing definite can be said now before some of the above-named questions have been discussed and settled.

However, it seems that some Working Groups should be formed to carry out activities, especially:

1) One Group should study the present organization of instruction in the various countries. This group would be able to furnish an up-to-date portrait of the situation everywhere. Information about the type, number and programs of present courses on automatic control and computation must certainly be obtained for the purpose.

2) Another Group should study problems concerning the various levels of instruction, as well as propose what lines should be followed at each level, both in grouping the subjects and in drawing up a program for each subject.

3) A third and last Group should consider questions of a general character, such as whether or not all IFAC countries could follow common lines of instruction and how far specialization should be carried. This Group could also examine relations, such as they now exist, between the various organizations interested in automatic control education. It would sponsor the formation of useful new organizations such, for example, as would foster cultural relations, and especially the exchange of teachers.

c) Meeting of the Committee on Education

The meeting of the Committee took place on the 24th June, 1960 at the Moscow University. Owing to the absence of Committee Chairman, Professor M a r i n o , Professor E v a n g e l i s t i took the presidence of the meeting on his behalf.

The Chairman read Professor M a r i n o ' s report, quoted above.

The discussion having been opened, the general points of view in Prof. M a r i n o ' s report were approved. Some specific items were discussed, and some amendments adopted.

One of the most important of them was the relation between the automatic control and the adjacent field of the Automatic Computation. It was agreed that this second field should intervene in the education and training of the first one if, and only if, the electronic computers are included in a control loop.

Another item which was given a particular attention was the formation of the working groups. It was agreed to emphasize the importance of a quick procedure in putting them into operation, particularly in the field of the exchange of teachers and technical informations.

The text of Professor M a r i n o ' s report was amended according to the above mentioned points of view, and was unanimously accepted in the modified form.

III. Closing Session, Saturday July 2, 1960

SPEECH OF PROFESSOR A.M. LETOV (USSR)
PRESIDENT OF IFAC

The first part of the Congress programme, reading of papers and their discussion, is closed. The second part of the programme, visits to industrial plants and institutes, will take place until July 7. And now we can talk about one of the most important results of our meeting: all the representatives of 29 countries present here have exchanged opinions on scientific problems as they wished it. This exchange was active, fruitful and enthusiastic. I am convinced of this from attending sessions on optimal and self-adjusting systems and also those on special mathematical problems. Information available from the Chairmen of IFAC Committees confirms this result.

The exchange of opinions took place in a spirit of friendship with the desire to widen scientific contacts. This is exactly the aim of IFAC. I must state with satisfaction that the National Committee of the USSR for Automatic Control has established the necessary conditions for this exchange and I would like to express once more my words of gratitude to this Committee on behalf of IFAC. I also wish to thank all National Member Organizations for the excellent cooperation with the Soviet National Committee, also all members of the IFAC Executive Council, the Honorary Secretary, the Honorary Editor, and the members of the Advisory and Technical Committees of IFAC.

All that has happened during these days in Moscow, at the Moscow University, enables us to state that IFAC is on the right lines, that this international organization is sufficiently strong and has sufficient authority, that its eventual aim - to contribute to the increase of the material wealth of mankind - is high-minded and that it is worthwhile to serve it.

It is quite possible that there are especially exacting or grumpy people who would point to some deficiencies in the organization of the Congress and of our international body of IFAC. We should probably have to thank such people, since their statements, independent of their basic intentions, will serve to strengthen IFAC and we shall use their indications in the future to correct our deficiencies.

Nevertheless, all that took place at our previous meetings of IFAC in Paris, Zurich, Rome, Chicago and now in Moscow gives us the possibility of answering our critics in terms of the English proverb:

"A good horse cannot be of a bad colour."

To conclude, I should like to express my hope that we meet in three years time in Switzerland at our new Congress, which will be organized by the Swiss National Organization under the leadership of Professor Ed. G e r e c k e . During these three years many things will change: many of you will write new books and make contributions to theory, others will create new elements of Automatic Control, and still others will obtain effective results in applications of Automatic Control. However, by these contributions we shall cooperate together in the further development of the prestige of IFAC and of its influence.

Let me wish you good and useful excursions, a pleasant journey and a successful travel through my country.

SYNOPSIS OF THE SECTION I "THEORY" OF THE CONGRESS

by ACADEMICIAN B. N. PETROV (USSR)

I have the agreeable and at the same time difficult privilege of s u m m a r i z i n g t h e w o r k o f t h e C o n g r e s s s e c t i o n s devoted to problems of Automatic Control Theory.

These problems have been covered in 9 sections by 139 papers, on account of which a large number of questions were asked and in the discussion of which over 330 participants of the Congress took part.

Such a high activity displayed during the discussion of Automatic Control problems characterizes the general status of the Automatic Control theory. The recent years, and particularly the last ten years, are characterized by an impetuous development of this young branch of science.

It was not accidental that many more papers were submitted to the Congress than it was possible to discuss and therefore many papers were not included in the programme of the Congress not so much on account of their poor quality as because a very large number of good papers had been submitted.

The discussion at the Congress of the most important problems of Automatic Control is a clear demonstration of the high level of development of Automatic Control theory and of the large use of rigorous mathematical methods for the solution of basic problems of analysis and synthesis of Control systems. During recent years some very general and powerful methods of solution of most complicated problems have been worked out.

Automatic Control theory has become an exact technical science provided with effective means for analyzing and calculating automatic systems. Statistical methods have practically penetrated into all the domains of Automatic Control theory. The maximum principle and dynamic programming methods gave a basis for the optimal system theory. The methods of mathematical logic were used for establishing the structure theory of automatic systems. The theory of discrete-relay and pulse-systems was formed. Invariance theories, methods for establishing multi-variable and self-governing control systems and in other new directions the theory has received considerable development.

At the present time, a general theory of Automatic Control has been formulated. Of course, many problems of Automatic Control are still unsolved and require further development of mathematical methods.

Besides the creation of new methods, further development has been achieved for methods already existing, particularly for the approximate calculation of Automatic Control systems, such as the Describing Function method, frequency response methods and others. These methods have attained a form convenient for use in engineering practice.

The motto of the Congress: "Wide applicability for theory, maximum reliability for components, high efficiency for applications" characterizes very well the direction of the work fulfilled during recent years in various countries.

Besides the discussion of main problems of theory and of methods already developed for calculating Automatic Control systems, the participants of the Congress devoted much attention to the discussion of new principles of establishing automatic systems and, particularly, of self-adjusting, self-adaptive and self-learning systems, of combined systems, of control systems using computers and logical elements and of other new types of automatic systems.

Let me proceed now with a short s u r v e y o f s c i e n t i f i c p r o b l e m s investigated in the various sections. I must apologize to authors of papers and participants of the Congress who took part in discussions for being unable, owing to the lack of time in this survey, to mention their names in connection with the problems dealt with in the papers and communications, the majority of which were very comprehensive and interesting.

In the section on c o n t i n u o u s l i n e a r s y s t e m t h e o r y probably the greatest interest and the largest number of participants in discussions were produced by the problem of invariance theory and of establishing multivariable and self-governing systems. The reason for this is probably the fact that technical progress results in more and

more complicated automatic systems, in the necessity of analyzing systems with several controlled variables, in the use of deviation-and-disturbance-actuated systems etc.

At the present time, theory gives already the main ways of establishing very perfect systems responding very weakly to undesirable disturbances and following most accurately control actions.

A considerable interest in this section was shown in multivariable structure synthesis, in methods and means for improving dynamic properties of Automatic Control systems with one or several controlled variables as well as in problems of theory of systems containing delay elements.

Interest was also shown in papers dealing with ways of improving stability criteria and of establishing more general methods for evaluating the quality of control systems so as to summarize separate methods of solving this problem, previously developed in various directions.

In this section, 23 papers were read and over 40 participants took part in the discussions.

The work of the section on c o n t i n u o u s n o n - l i n e a r s y s t e m t h e o r y , in which 14 papers were read, was devoted to the large domain of problems of non-linear continuous Automatic Control system analysis and synthesis. A survey of methods (exact as well as approximate) for investigating such systems was given.

A large set of papers was devoted to the development of the D e s c r i b i n g F u n c t i o n m e t h o d . This method, largely used in engineering practice, was extended, in matrix form, to the case of multi-periodical oscillations, to the investigation of phenomena of subharmonic resonance, of oscillatory synchronization, of parametric amplification etc. Induced oscillations in non-linear systems were investigated. A combination of the Describing-Funktion method with the statistical linearization method makes an approach to the solution of some problems of random-process system synthesis possible.

The application of different variants of the h a r m o n i c l i n e a r i z a t i o n m e t h o d allows the investigation of the influence of feed power constraints in Control systems, the conditions of suppression of auto-oscillations by means of an external periodical action and of suppression of auto-oscillations in systems containing backlash.

A variant of the harmonic linearization method using logarithmic frequency response characteristics was also investigated.

In the course of the discussion of papers two viewpoints were expressed. One of these consisted in the statement that the Describing Function method, whilst being most effective, should be used with caution as a lack of points of intersection of describing functions does not give a sufficient stability criterion. For instance, when points of intersection are lacking, complex auto-oscillations can take place in the system.

The other point of view consisted of the statement that the Describing Function method is very powerful and simple, that it can be extended to the research of sub-harmonic solutions and that, in cases occurring practically, it gives correct results.

In the course of the meetings of this section other questions were investigated such as problems of programmed alterations of the amplification gain for the quality of processes, problems of use of semi-proportional elements in controllers, of calculation of static characteristics in complicated non-linear systems and of a new method for calculating the integral quadratic estimate of non-linear Control systems.

One of the new and rapidly developing directions of Automatic Control theory is the d i s c r e t e s y s t e m t h e o r y . The basic problems in this field are problems of analysis and synthesis of usual automatic systems including relay, pulse and digital systems as well as the development of methods for establishing optimal and self-adjusting discrete systems.

In the field of R e l a y S y s t e m t h e o r y , the main attention in the papers of the Congress was devoted to the exact and approximate methods of analysis of sub-harmonic oscillations. Problems of optimization according to the speed of action in random processes were also investigated.

The largest attention was devoted at the Congress to p u l s e s y s t e m s . A survey of mathematical methods for investigating such systems was made, considerable attention was devoted to the calculation of multi-loop and multi-variable systems, systems with variable parameters and methods of statistical calculation of pulse systems.

In the papers submitted, difficult problems referring to non-linear pulse systems were also quoted. Here was used the phase-plane difference method with the assistance of which were developed methods for investigating amplitude-pulse systems.

In the field of optimal pulse systems, were investigated problems of choice of structure of such systems without applying constraints and with constraints of the type of saturation and according to energy. Were also investigated methods for establishing self-adjusting systems with a feedback according to a figure of merit.

In the field of relay-pulse (digital) system theory, the simplest systems of this type were investigated on the basis of the phase-plane method and of the introduction of a random delay.

Elements of digital Automatic system theory were developed. An estimate of the quantization effect was given, a method of investigating periodical conditions was developed as well as a method of synthesis from the conditions of compensation of delay and the realization of optimal processes.

Some of the papers read in this section contained new ideas and methods not yet published. Amongst the more interesting ideas in the field of discrete Automatic system theory are the idea of establishing self-adjusting pulse systems on the basis of a feedback according to a figure of merit and the establishment of optimal digital systems on the basis of the dynamic programming method.

In this section a large and fruitful discussion took place. The most lively discussions referred to problems of applying digital computers to pulse Control systems, of investigating non-linear pulse systems by means of phase-space methods and of using operator methods for pulse Control system analysis.

The necessity of developing methods for analysis and synthesis of non-linear pulse systems and of random process systems was stressed.

In the section of s t o c h a s t i c p r o b l e m s of Automatic Control, several scientific directions were discussed.

One of the main problems of modern s t a t i s t i c a l t h e o r y of Control systems is the statistical analysis and synthesis of non-linear systems. In papers devoted to this problem and in discussions of these papers, three different directions of investigation in this field appeared:

- The development and the generalization of the statistical linearization method and of its applications;

- The establishment of an exact theory of a given class of non-linear systems on the basis of Markov's theory of random processes;

- The development of methods of synthesis of systems amounting to linear systems.

In the course of discussion, great interest of scientists from several countries was devoted to the statistical linearization method, the idea of which is close to that of the harmonic linearization method in the deterministic theory of non-linear systems. In the field of application and analysis of Control systems of the Markov's random process theory, Soviet scientists taking part in the discussion quoted several interesting

results unknown until then in other countries, in addition to interventions of the authors. In the field of statistical theory of non-linear systems amounting to linear systems, in the course of discussions several interesting results appeared, which have prospects of being applied to the calculation of self-adjusting and self-optimizing systems.

The second interesting direction around which arose a lively discussion was the theory of statistical synthesis of linear systems. In this field, well developed in works of American and Soviet scientists, the discussion showed the apparition of two mutually-competing directions in the USA. The first direction is the application of the dynamic programming method in order to determine the optimum programme of the controlling part. The second direction is the establishment of methods for finding directly the differential equations of the optimal system.

A great interest was also achieved by the problem of finding the a l g o r i t h m s o f o p t i m a l s y s t e m s . In this field, the Congress demonstrated the fact that most problems of retrieval and optimal processing of information in the presence of random noise and disturbances can be considered from the same view-point and solved by the same general theoretical method.

Besides papers and discussions referring to the three mentioned main directions, in the section of stochastic problems were discussed problems of experimental determination of characteristics of systems and controlled plants and of statistical characteristics of random processes, of statistical calculation of linear systems, of investigation of errors when transforming a continuous information into discrete information as well as the problem of application of the information theory in order to estimate the transfer capacity of automatic systems and their elements.

In the section of o p t i m a l s y s t e m t h e o r y 12 papers were discussed. The discussion involved about 40 participants. In this section were discussed questions of optimal system theory covering general methods of investigation of optimization problems as well as results concerning a detailed study of separate definite problems.

The general methodology is mainly concerned with the elaboration of methods for solving non-classic variational problems. In this respect, great interest was shown towards a paper devoted to the maximum principle in the theory of optimal Automatic Control systems. All those who took part in the discussion stressed the fact that this principle provides a powerful method for investigating non-linear optimization problems when the constraints of governing functions are very general. At present, the maximum principle makes the solution of a very large class of problems possible.

Much attention in this section was devoted to questions of optimal system synthesis. In this respect were discussed methods of reverse time and methods for determining iso-surfaces in the phase space of the system based on the application of the maximum principle. In the course of discussions, definite examples of synthesis of practical systems, based on the application of the methods mentioned, have been already quoted (synthesis of a 3rd order system, optimal according to the speed of action).

In the discussion the relationship between the maximum principle and the dynamic programming method was investigated. The dynamic programming method when applied to problems of optimal control leads to functional equations closely related to the equations of the maximum principle. However, it has been pointed out that the dynamic programming method comes upon considerable computation difficulties.

An interest was also shown towards the formulation and the solutions of some optimal control problems for a system with distributed parameters described by partial derivative equations and also towards general and particular questions of linear optimal control system theory.

In the section of s e l f - a d j u s t i n g s y s t e m t h e o r y , 20 papers were read. The systems investigated were of biological and of mechanical nature and were able to adapt themselves to varying conditions so as to insure an interaction between the controlled unit and its environment which would result, in a given sense, in the best state of the controlled unit. In this section were investigated systems insuring adaptation either by means of an automatic search or by means of a variation of the state of the system in open or closed sequence without any automatic search.

Discussion referred to problems of statistical theory of automatic optimization systems, of self-adjusting system dynamics, to problems of bio-electric control and to some features of physiological control systems as well as to questions of self-adjusting auto-pilot theory.

The discussion in the section of self-adjusting systems seemed to be one of the most lively and the audience - the most numerous. As a rule, this section was attended by over 200 listeners. Over 70 participants took part in discussions. Over 200 questions have been asked. This confirms a particular attention of scientists towards this very important and prospective direction of Automatic Control theory.

Interesting papers were read on the theory of u s e o f c o m p u t e r s intended to determine approximate characteristics of controlled units and of self-adjusting systems. A lively discussion took place on papers referring to questions of bio-cybernetics. Soviet, Yugoslavian and American

scientists made a considerable contribution to the preparation of the theory for establishing systems in many respects similar to living structures. Six papers in this section were devoted to questions connected with the study of self-adaptive systems of biological nature. A well-merited attention was drawn by the results obtained by a group of scientists in the problem of bio-electric control which allows to use bio-currents generated in living structures in order to control artificial organs replacing the lost ones.

The investigation of b i o l o g i c a l s y s t e m s by means of Automatic Control theory methods became recently more and more usual. This cybernetic direction begins to yield interesting results and has been expressed in papers of the Congress.

In several papers and discussions the necessity of investigating and calculating self-adjusting systems capable of working with a swift drift of the controlled unit characteristics and parameters has been stressed. These questions are closely connected to questions of stability of the self-adjustment process. This is why the importance of an exact mathematical formulation of the stability criterions of self-adjusting systems under various conditions of their work has been frequently stressed in the course of discussion.

The s t r u c t u r e t h e o r y o f r e l a y d e v i c e s is presently one of the most important directions in Automatic Control theory. It has been created in order to be applied to problems of relay system analysis and synthesis, but presently its methods are used for solving a large scope of Automatic Control problems. On its basis are developed several directions of modern common theory of computing and controlling automatic devices: logical- and nerve-network theory, finite automata theory etc.

The signal elaboration theory is very close to the structure theory of relay devices.

In the section of s t r u c t u r e a n d s i g n a l e l a b o r a t i o n several important questions of relay device theory and of signal elaboration theory were dealt with, amongst which were problems of creating methods for relay device synthesis, of establishing relay structures with a given reliability, of using a new logical language for describing discrete sequences, of mechanizing relay device analysis and synthesis processes, of insuring disturbance-proof and effective transmission of information in remote-measuring systems.

Although the problems investigated in this section were important and up-to-date, many problems of modern structure theory and of signal elaboration theory have not been brought forward on account of the limited number of papers in this section and, particularly, of the absence of papers from pro-

minent scientists of the USA and of other countries working in this field. This gap was partly filled by interventions of Soviet and foreign scientists in the course of the discussion of the papers read in this section. It is visualized to organize in the future a special symposium on relay device theory and connected scientific directions.

At the meetings of the section of special mathematical problems several scientific directions were discussed.

The first direction comprises questions of investigating steady-state conditions in Automatic Control systems described by differential equations with continuous right-hand members. In papers referring to this direction, several important aspects of this problem were brought forward. The notion of stable steady-state conditions has been precisely specified and has received a strict mathematical definition, the results of an investigation of the dependence of periodical solutions of a system of differential equations from parameters have been formulated.

The second mathematical problem discussed in this section was that of investigating non-linear systems with lumped characteristics. In this field, questions of defining steady-state conditions in similar systems were discussed. The discussion of papers showed a vivid interest of scientists towards these problems.

The third problem discussed in this section was that of stability of controlled systems. The main questions referred to in papers and in the course of a lively discussion concerned a further development of means for determining stability using the second method of Liapunov.

In the section of simulation and experimental methods of investigation 11 papers were read and 12 participants took part in the discussion.

The problem of application of simulation and experimental methods for investigating and creating complicated control systems attracted the deserved attention of all present. Simulation methods, which are using now not only analog but also digital and combined devices, allow to mechanize given elements of human brain-work and highly contribute to the increase of its efficiency. Experimental techniques are precisely stated and preliminary conditions are created for a great economy of means necessary for carrying into effect real tests.

In papers and discussions the development of digital simulation means and methods was mentioned. New methods were proposed for reproducing second-order curves by means of digital devices applied to programme control systems as well as combined digital-analog devices (for instance

in order to reproduce the Kinetics of a nuclear reactor). The use of digital methods insures, besides an increase of accuracy, a fairly larger range of acceptable variations of the variables.

Great attention should be given to the proposed method of solving on electronic computers partial-derivative differential equations based on the relationship existing between these equations and random processes occurring in electric circuits submitted to random disturbances.

An original high-frequency A.C. simulator comprising passive circuits combined with multiplying follow-up systems, described in one of the papers, insures a relatively high accuracy and is characterized by the feature of reversibility (including non-linear elements), which fairly widens the possibilities of the proposed device.

New ideas in the field of optimization of work of industrial process control systems using electronic simulators open large prospects for calculating optimal systems as well as for increasing the precision of the mathematical description of processes to be controlled.

I believe that I shall express the feeling of all present at the Congress if I state that the presentation of the papers, their fruitful discussion and the wide exchange of views between scientists of various countries, which took place in a most friendly atmosphere, will have a great influence on the future development of Automatic Control theory and will contribute to a still more effective development of this young branch of science and engineering. A new bright page has been written in the history of science.

SYNOPSIS OF THE SECTION II "COMPONENTS" OF THE CONGRESS

by Mr. Gy. BOROMISZA (HUNGARY)

In technical life there has always been a gap between theory and practice; sometimes theory has been ahead, but the contrary has not been a rarity either. Examining now the contents in its groups and the numerical distribution of the papers read on the First Congress of IFAC, it becomes clear how great the gap is between theory and practice; the practical realization has difficulties in following the theory which leads far ahead. This is - in the present state of development of technical life - natural and correct, if theoretical considerations are able to follow several paths towards solutions, experiments must be carried out before the best methods can be chosen.

Control problem realization is based upon control systems components and the quality characteristics of the components as well as the development of a control scheme determine control quality. One of the main viewpoints when studying congress papers has been the question of what kinds of new methods and improvements are dealt with, what kinds of recent tendencies of development are reported, are there any improved calculation methods rendering possible the construction of better components, what types of new constructional possibilities are available, to what kind of new methods of application are they leading, are there any new methods of increasing reliability, are there any fields which need particular consideration for development, has there been any mention of measuring methods with which the measurement of particular characteristic parameters or measurement of quality may be realized.

When talking of components, it is advisable to find some order. The Technical Committee on Components suggested the study of components and their characteristics according to information obtained from the controlled process. Thus we may talk of components giving information of the controlled system, e.g. sensing elements, transducers, then there are the components transmitting information, the components designed to process information and last the final elements.

Another viewpoint of our study can be the character of the component, such as hydraulic, pneumatic, electrical in character, and so on - and the economic factors should not be left out either.

The papers read in the Section "E l e c t r i c a n d M a g n e t i c E l e m e n t s o f C o n t r o l S y s t e m s" dealt with methods of calculation, application and measurement of electrical quantities. Some of the papers discussed the determination of characteristic data for magnetic amplifiers by means of calculation. Authors emphasized that today there are good methods for designing magnetic amplifiers and that calculation is in good accordance with experiment. The dynamic properties of rectangulat hysteresis loop cores and their influence on magnetic amplifiers have been dealt with too; it was proved that the influence of magnetic inertia plays an important part in the industrial frequency range. Another paper discussed the performance of ferromagnetic materials with hysteresis loop of a rectangulat type where in calculation methods the eddy currents and the self-capacity of coils has also been considered.

Electrical component parts have been talked of and there was a paper presented of new types of photo-resistance and their field of application; a high speed stepping motor was dealt with too and its behaviour was analysed.

Two papers discussed automatic measuring methods, one dealt with a quasi-balanced bridge as an element in an automatic control system showing realization of the compensation of real and imaginary parts of impedance. The other gave new principles of construction of digital binary coding automatic compensators: new schemes were examined for parallel voltage dividers for binary coding automatic potentiometers.

A later paper dealt with logic elements and their use as static relays in sequential circuits, stressing that memory units are not needed because sequential circuits can be obtained with standard logic blocks by providing feedback connections from the output to inputs of the same or other blocks.

Summing up it may be said that magnetic amplifiers still play an important part in control systems, particularly as power amplifiers, as static relays and in connection with semi-conductors. Altogether nine papers were read in this section.

The Section "E l e c t r i c C o m p u t i n g a n d A n a l o g D e v i c e s , P r o g r a m m i n g E l e m e n t s a n d C o n t r o l l i n g M a c h i n e s" discussed, first of all, the construction of synthethizers, of new computers for algebraic functions of a complex variable, the discrete-space-discrete-time computer which is a network type simulator designed for the solution of transient field problems; it differs from other analyzers in that the time as well as the space variables are approximated by finite difference expressions and that the solution is obtained in discrete steps in time. The Section discussed further a computer process control system with ternary coded telemetring selector for centralized process control, a general purpose transient field simulator and automatic optimizers and their use for solving variational problems and for automatic synthesis.

The second group in this Section dealt with computers used in automatic processes. To this group belongs the electronic digital computer Skrzat which is designed for processes such as chemical synthesis, distillation and blast furnaces. The reliability and life of service are high.

The third group in this Section dealt with the improvement of constructional elements of computers. To this group belongs a paper on automatic control of zero level of an operating amplifier. Authors presented circuits used for reduction of zero drift, investigated the system of automatic control of zero level and evaluated the different circuits. There was another paper on non-linear computing blocks made from non-linear semiconductor resistors of silicon-carbide, the characteristic of which is highly stable and symmetrical and has a high degree of non-linearity. Descriptions of the design of several function generators with silicon-carbide resistors such as sine-cosine and other generators are given.

Furthermore a paper was read on the logical method of synthethizing function generators, which is an important step forward in this field.

Summing up: Computers play a very important part in analysis and synthesis of control systems, particularly in the field of non-linear systems. Altogether ten papers have been read in this Section.

"Transducers, Elements and Systems of Automatic and Remote Process Control" were discussed in the third Section. The greater part of the papers dealt with contactless telemechanical systems. The papers as well as the discussions emphasized the wide possibility of this trend of development and mentioned new constructional methods of telemechanical systems for scattered objects.

In the field of telemetry there appeared a tendency to construct systems of transmitting information with discrete values by means of code methods and digital recorders. The development of this system is also based on contactless elements such as semi-conductors and ferrites.

The papers as well as the discussions laid special stress upon reliability and accuracy. The future trend of development in telemetry is in contactless systems, code-pulse systems with discrete values as well as telemechanics of numerous scattered objects.

The paper dealing with the indices of assessment and of the possibility of improving the quality of telemetric systems proved to be a great interest. The given indices are, among others, the index of the specific content of the signal, the index of the quality of reproduction, the index of efficiency of use of the flow capacity of the system, the index of the technical economic quality of the system.

In this Section eight papers were read.

The papers presented in the Section on "Pneumatic Automatic and Computing Devices" as well as the discussions which followed them prove that development continues in this field. Particular attention should be paid to the development of pneumatic calculation methods and computers. A paper on application possibilities of pneumatic analogues was read discussing problems of synthesis, stability and the influence of connecting pipes. The realization of pneumatic analogues is obtained by pneumatic RC networks.

Another paper discusses pneumatic calculating machines as a means of ensuring the reliability of integrated automatic systems which contain a memory unit, an integrating unit, a differentiating link, a retardation unit, a functional unit and a pneumatic unit. Author emphasizes the reliability and accuracy of this computer.

The paper on fundamentals of theory and calculation of elements of pneumo-automation was of interest. It showed to what degree the aerodynamic theory might be used for designing pneumatic instruments and also for hydraulic devices. Particular attention was paid to the influence of excentricity.

For pneumatic relay circuits authors emphasized the application of pneumatic relays as logic elements and pointed to their reliability.

Another paper discussed the optimum design parameters of pneumatic jet-pipe valves and presented experimental pressure flow displacement relationships for a conventional jet-pipe valve operating with compressed air. Optimum design conditions were established on the basis of a maximum power transfer condition. Compared with other typical valves from the standpoint of power transfer reliability the jet-pipe valve offers several advantages over the more commonly used flapper-nozzle and spool-type valves.

A pneumatic flapper valve study gives a theoretical analysis of a pneumatic flapper valve connected to a fixed volume filled with gas. It also describes some experiments in which the force on the flapper of a flapper valve was measured.

A high performance servo-valve with flow feedback is discussed in another paper. It points to the very fast response and improved load sensitivity. Another paper reported the investigation of the hydraulic drive dynamics for copying machine-tools.

The paper on dynamic support of instrument components by viscuous fluids dealt mainly with gyroscopes and raised vivid interest.

Summing up: ten papers were read in this Section dealing with fundamental theoretical calculating methods, computers, component parts and hydraulic devices.

The papers presented in the Section on "Systems and Devices of Automatic Control" discussed different problems. Some dealt with sensing elements. A thermomagnetic compensating gas analyzer was presented, the advantage of which is that it is applicable to the accurate measurement of oxygen of high concentration within a narrow band. The use of radio-activity in the automatic control of mining, extracting and cutting machines was shown and the automatic steering system was discussed.

Other papers reported on improved measuring methods, on the automation of sampling and chemical analysis, on automatic testing and on the transfer meter for nuclear reactors.

There were papers read about gyroscope sensing of satellite yaw and equipments using nuclear radiations.

Some of the papers dealt with the improvement of component parts as, for instance, temperature rises in these parts, and the selection of optimum vibrations for eliminating Coulomb friction.

The reports on the results of some countries and organizations obtained in the field of accurate static and dynamic measurement as well as in designing certain automatic equipments raised much interest.

In this Section 18 papers were read.

In evaluating scientific results, particular attention should be paid to the following p r o b l e m s :

1) Basic methods of designing sensing elements and transducers with regard to construction and automated measurements.

2) New principles for obtaining and processing data, including the centralisation of more and more individual data processing equipments, to make a wider use of digital techniques, the development of indices of assessment of components, and the development of new types of regulators.

3) The most effective methods of transmitting information in automatic and telemechanical systems, investigation of the effectiveness and reliability of telemechanical components and channels, the elaboration of complex telemechanical systems for transmission of discrete and continuous values, wider use of contactless elements.

4) New control devices and methods, wider use of semi-conductors and magnetic amplifiers, construction of pneumatic and hydraulic components based on the jet principle, further development of technology, such as printed circuits and miniaturization.

5) Economic and technical problems in connection with the selection and production of components.

Finally let me make some statistical remarks: 55 papers were read in Section 2. The number of participants has been about 1500, 57 people took part in the discussions.

Papers and discussions were on a high scientific level and made clear how theory can be applied to components.

All the sessions were held in a friendly atmosphere, improving the ties between scientists of different countries and widening international scientific relations.

And now let me express my warmest thanks towards our hosts, the Soviet National Committee on Automation, for their kind hospitality.

SYNOPSIS OF THE SECTION III "APPLICATIONS" OF THE CONGRESS

by Dr. J.M. MOZLEY (USA)

On behalf of the Technical Committee on Automatic Control Applications of IFAC I would first like to express our appreciation to our hosts at this Congress: the USSR National Committee on Automatic Control, the State Committee on Automation and Machine Building and the State Committee on Science and Technology, for their generous hospitality and co-operation.

Also I would like to give our warm thanks to the authors of the 81 papers on applications, the many people of the national member organizations who solicited, reviewed and discussed the technical papers originating from approximately 20 countries. Thanks are due also to those people who presided at our sessions, acted as secretaries of the sessions and the interpreters. You have all done a wonderful job.

First, I would like to say that this summary report expresses not only my views but also the views of the Session Chairmen and Vice-Chairmen, whose reports were collected, condensed and edited by the USSR National Committee for Automatic Control.

I now would like to make some specific remarks concerning our thirty technical sessions on applications. In accordance with the scientific program of the Congress, these sessions were divided into the following areas of industrial application of automatic control systems:

1. Automation of the machine building industry
2. Automation of power systems
3. Automation of chemical and oil refining industries
4. Automatic electrical drives
5. Automation of metallurgical processes
6. Miscellaenous applications.

Sixty-seven papers were verbally presented at these sessions and contributed by Austria, United Kingdom, Belgium, Canada, Hungary, German Democratic Republic, Italy, China, Poland, Norway, Roumania, USSR, USA, France, Finland, German Federal Republic, Czechoslovakia, Switzerland, Sweden and Japan. Considerable interest was aroused by most papers. This is illustrated by the fact that 372 questions were submitted to the authors and the discussions were presented by 76 delegates and guests.

In the session on the automation of the machine building industry, principal attention was concentrated on the study and simple solution of problems involving the design and practical realization of automatic control systems for various machines. These problems are, first, the establishment of optimal relationship for machine operation, second, the selection of the most effective and simple devices for recording various types of data, and third, selection of computing and programming devices.

Covered in the program were the basic trends in the development of programming techniques for machine tools as well as a number of detailed problems concerning the stability and reliability of their operation.

In the discussions, speakers stressed that digital control methods play a particularly important role in the machine building industry. Many delegates suggested the organization of an international conference on the special topic of digital machine tool control in shipbuilding.

Twenty-two papers were heard in the session on the automation of power systems. Both the papers and the discussions have added to our knowledge in the fields of theory and application of automatic process control. Some of the most significant results are:

Derivation of equations describing the static and dynamic characteristics of such interesting plants as boilers, nuclear reactors, heat exchangers and others.

Collection of experimental data characterizing the control performance of several types of industrial process like furnaces and power plants. New criteria for process optimization have been suggested which consider the influence of control error on the economics of plant operation.

A number of effective automatic systems for the control of important plants such as boilers, nuclear power reactors, metallurgical furnaces and fractionating columns have been cited.

Some new ideas related to the principle of optimization of process performance have been expressed, and first steps have been made in the determination of the applicability of self-adjusting systems of several types. For a number of processes the effect of the variation of important parameters and characteristics on controlability have been established.

The sessions indicate that the most important problems existing in the automated power plant field are:

The formulation of a mathematical description of the static and dynamic properties of controlled processes.

The experimental evaluation of the same.

Investigation of the nature of the disturbances.

Determination of control quality criteria and finding the ultimate factors limiting their improvement.

The selection of an effective and economical structure of automatic control.

Development methods of automatic optimization of control parameters for changes in operating conditions.

Development of methods of increasing reliability.

Development of methods for maintaining safe operating conditions.

In the solutions of the problems stated above one should take into consideration such complicating factors as, for example, multivariable systems, systems with distributed parameters and unusual system constraints.

Eight papers were presented in the sessions on the automation of chemical and oil refining industries. Attention at these sessions was concentrated on two major problems:

Firstly - the study of the dynamic properties of controlled processes.

Secondly - the application of computers for the analysis and design of processing systems and for on-line control.

The lively discussion on the latter subject indicates that the development of automatic computation techniques has not lessened the importance of mathematical description of processes but rather has led to an increase of interest in them.

A typical example of the use of computers to calculate the control characteristics of processes was a paper describing the control of counter-current mass transfer in the separation of multi-component mixtures. The study of such processes is an extremely necessary stage in the design of fully automated plants. The application of on-line process computers was treated only in general terms indicating that they are not intensively being used at present for direct control of industrial processes. Major problems that are encountered in the automation of the chemical and oil refining industries can be summarized as follows:

The dynamic characteristics of individual processes and systems of them both in detail and in the broad sense need to be established.

There is need to develop improved approaches for the design of optimizers for technological processes.

Criteria for computer applications based upon economic justification should be established.

Full scale automation demands the establishment of general principles which permit the optimum selection of the controlled and manipulated variables.

At the session on automatic electrical drives ten papers were presented and discussed. Considerable interest was expressed in the following topics:

New techniques for speeding transient response in automatic electric drive systems.

New components and devices.

Methods employed for synthesizing non-linear automatic drive systems.

Some general problems being faced by those working on automatic electric drives include:

The need for further development and wider application of techniques for analysis and synthesis of fast-response optimum drive systems.

Requirement for wider use of on-line computers to control the operation of electric drives.

Need for developing new compact reliable devices to improve transient response. Also required are improved devices of higher accuracy.

Thirteen papers were presented and discussed in the sessions on automation of metallurgical processes. The discussion of these papers was a valuable contribution to the theory and practical application of automatic control in this area. The important results were as follows:

Equations which adequately approximate the steady state and dynamic performance of several important processes have been obtained. A vast amount of experimental data has been acquired.

New instruments and automatic systems have been developed and tested under operating conditions for the control of several complex processes. In a number of such control systems self-adjusting principles and computing devices have been widely used.

Basic principles of full scale automation have been outlined for individual complex processes as well as complete plants.

The discussion indicated that general principles for the design of mathematical models of complex processes require further development. A uniform approach to the solution of the problem of designing overall automatic control systems for a group of inter-connected processes has not yet been found.

It seems that the fundamental problems facing us in this area are:

We must further develop and improve the techniques used for analytical description of complex controlled processes.

From this analytical description and experimental data must be developed the general design principles for complex groups of inter-connected processes.

There is also an urgent necessity to formulate criteria to evaluate the figure of merit for complex equipment such as rolling mills, blast furnaces, open hearth furnaces, sintering plants and many others. These criteria must be based on the overall economic approach and take into consideration the reliability and cost of the control system. Further improvements in the reliability of control system components employed in the metallurgical automation systems are required due to the very severe conditions under which they operate.

The papers show that much progress has been made toward a solution of these problems.

Summarizing this survey I would like to point out that the papers presented at the sessions on applications contained extremely valuable scientific information. They reflected to a certain extent our experience and the level of knowledge reached in the applications field and provided a basis for most interesting discussions on major problems.

It should be stressed also that the meetings of the applications sessions were conducted in a friendly and efficient manner which provides the basis for further development of international scientific relations, strengthening of friendship and mutual understanding of scientists in many countries.

REPORT OF THE CHAIRMAN OF THE IFAC ADVISORY COMMITTEE

by PROFESSOR DONALD ECKMAN (USA)

1. Six Technical Committees are formed:

   Applications
   Bibliography
   Components
   Education
   Terminology
   Theory

2. Chairmen have been nominated.

3. Membership has been formed, but there is still the possibility for more members to work with Committees.

4. General Duties:

   A. Preparation periodically of a review of the state of the art.
   B. Preparation of exchange of standards.
   C. Exchange of information.
   D. Preparation of Congresses.
   E. Preparation of Special Symbols or Terms.

Applications Committee

A. Fields of interest for initial work:

   1. Aeronautical - Astronautical
   2. Chemical - Petroleum
   3. Electrical
   4. Machine Tools
   5. Metals
   6. Nuclear
   7. Textile
   8. Bio-Medical
   9. Power Generation
   10. Paper and Pulp
   11. Ceramics

B. Preparation of a review of Outstanding Literature in Applications of Automatic Control - hope to make available by February 1961.

C. Participate and co-operate with other International Organizations such as the Meeting on "Simulation of Chemical Processes" held in Belgium, on November 20 to 23, 1960.

Bibliography Committee

A. Committee operating with UNESCO through prof. Broida compiled a list of 757 titles of books on Automatic Control - list available at Congress Book Exhibition.

B. Work will be continued to include periodicals and papers - continuing the co-operation with UNESCO.

C. Work will be continued on the development of a classification system for Automatic Control Literature.

Components Committee

A. Determine which fields of interest belong to Components.
B. Determine the kind of data which characterize Components.
C. Determine Measuring Methods which are necessary to measure components characteristics.

D. Investigate existing Standards and Practices in the various Countries.
E. Participate in the meeting IMEKO in 1961.
F. Exchange information on Components.

Education Committee

A. Educational levels to be considered:

   1. Research Science
   2. Engineering in general
   3. Design
   4. Installation
   5. Maintenance

B. Fields of Education:

   1. Applied Mathematics
   2. Applied Electronics
   3. Automatic Control
   4. Automatic Computation

C. Work continues on:

   1. Exchanging information in these fields.
   2. Study of various teaching methods in various countries.

SPEECH OF PROFESSOR ED. GERECKE (SWITZERLAND), FIRST VICE-PRESIDENT OF IFAC

Automatic Control is to-day nearly 200 years old. It began with the Automatic Control of water and steam turbines. To the latter were added some devices such as a centrifugal controller, a valve. Then it appeared, in a most surprising way, that such controlled systems had a tendency to oscillate. After having further investigated this phenomenon, it was established that precise conditions, able to be formulated mathematically, had to be fulfilled in order to obtain a stable system. The formulation of these conditions was achieved with success by R o u t h (USA), S t o d o l a and H u r w i t z in Zürich as well as by the Russian scientist L i a p u n o v in France. Then appeared electronic tubes and N y q u i s t found in 1929 his famous theorem of stability. The development then went swiftly forward, new ways of amplification were added such as electro-mechanical amplifiers, amplidynes and magnetic amplifiers. Very fundamental progress was achieved by the advent of new solid bodies such as semi-conductors and ferrites.

It was universally recognized that all these control systems had common basic laws which were independent of their material structure. This resulted in a new theory and in a new science

which were now no more an appendix of other sciences such as mechanics or electronics. A new independent science was born, the Automatic Control Theory. It was recognized that through an automatic system were flowing signals which were transferred, associated and transformed in a given way. This new theory had therefore to take care of signal processing and Automatic Control of signals and to establish the corresponding definitions and laws.

In this way, an entirely new condition was created. Automatic Control was originally born in separate fields such as machine-building, hydraulics, pneumatics, electronics etc.

The practical man created for his needs concepts and definitions which, considered now as a whole, did not fit together. Thus it became necessary to create for the whole field of Automatic Control a unified language with unified concepts and unified definitions. This is the immediate task of the Technical Committee on Terminology.

What is now the extent of this task? To this domain belong open and closed loops in which also analog or digital computers can now be included. Then come multiple control actions, follow-up controllers, sampled-data control systems and, further, self-adaptive, self-optimizing and self-learning systems. It is now necessary to establish concepts and definitions which would cover all these fractional fields. This is certainly not an easy task. The Technical Committee on Terminology can build upon fundamental work carried on in the USA, in Germany, in Switzerland and, in the framework of the IEC, in France.

The Technical Committee does not intend in any way to deprive these organizations of any part of their work. It extends to fit together the existing definitions and to melt them into a new alloy. It also has the intention of giving Automatic Control definitions in five or six languages.

An entirely new and important contribution has recently been made by the Soviet Committee for Automatic Control. A fortnight ago, I received from Professor G a v r i l o v a manuscript of some 60 pages which refers to the basic definitions of an entirely universal control system. Professor G a v r i l o v starts in this paper from a new concept, the algorithm.

An algorithm is the entirety of precise instructions and orders established by the constructor of a control system in order to conduct a given process. As you see, this allows the definition of a control system in a very general way. From this follow the definitions of a signal, of a transfer element, of the direct action path, of the feedback path, of the automatic system. This provides a powerful logical synthesis which is certainly necessary for the creation of a terminology. Perhaps, this raises doubts in your minds. Perhaps

you are anxious lest an entirely theoretical construction be born which would finally be formulated so generally that nothing tangible would result. You think perhaps that this would be the work of some confused professors without their feet on the ground. "Grey is all theory" has a dual law: "Nothing is more practical than a good theory". Therefore, care will have to be taken also in this respect, limitation to what is essential to-day will have to be considered and reasonable limits will have to be defined.

Another task of the Technical Committee on Terminology is the arrangement of letter symbols as well as graphical symbols in Automatic Control. You will find in this respect a collection of the latter in IFAC Bulletin No. 6, pages 17 to 72. These graphical symbols are based, first of all, on signals, association of signals, signal processing and signal transfer.

This is, therefore, a theoretical set. Later on, the Technical Committee on Terminology will take care of components and will therefore base its work upon the work of the Technical Committee on Components. For components, there already exists a set of graphical symbols such as have been established by existing organizations such as IEC, ASA, DNA, SEV. These will not be altered, they will simply be taken and included in the universal symbol of a transfer element: a rectangle. It has appeared from precise analysis that only very few new symbols are necessary, namely for amplifiers. Then, for transducers, inverters, information or energy converters: a rectangle with a diagonal. Further, a symbol must be created for storage elements such as energy storage, information storage, memory and then for the regulator and the whole controller.

You must have seen from the preceding that the Technical Committee on Terminology will have to accomplish during the coming year an enormous work. It relies for this on the assistance of National Member Organizations.

I would like to conclude with some general remarks. We have spent a week here in Moscow. Scientific discussions were certainly very interesting for all participants. Particularly important has been the establishment of personal contacts between scientists of separate fractional fields. We have also had an insight into Russian life and Russian culture. Such was, for instance, the ballet performance on Thursday evening, which was simply splendid.

I would like to thank prof. L e t o v, prof. T r a p e z - n i k o v and all their numerous associates for this extraordinarily interesting Congress and for the great work they have accomplished for it, as well as Dr. R u p p e l and the members of the Executive Council of IFAC.

The Second Congress of IFAC will be held in September 1963 in Switzerland and I should be glad to welcome you there.

IV. LETTER OF THE IFAC PRESIDENT TO THE HONORARY EDITOR

Dear prof. B r o i d a, Moscow, October 22, 196o

After having returned from vacations, I have read several records of our Congress made by outstanding scientists, participants of the Congress, and published in several magazines.

I have also received several letters from presidents of IFAC National Member Organizations in which they express their gratitude to the Soviet Organizing Committee and to myself for a sound preparation and a good work of the Congress.

It is useless to say what great satisfaction all this has brought to me. I would like to express in the present letter all my thanks to the authors of these letters for such a high appreciation of our activity.

However, I believe that, although the main strain of organizing the Congress was laid on the Soviet Organizing Committee, all the officers of IFAC, presidents of IFAC National Member Organizations and participants of the Congress have also contributed to the success of the Congress within the scope of their forces and of their positions and have therefore to share our success.

I particularly appreciate the above-mentioned publications as they reinforce IFAC and give to a certain extent a good pattern of relationship between scientists and engineers of 29 countries having attended the Congress.

I should appreciate if you would publish the present letter in the Bulletin reporting on the Congress.

Sincerely yours

prof. A.M. LETOV
President of IFAC

(Translated from
the Russian Language)

WORLDWIDE AUTOMATIC CONTROL

Argentine

On December 5, 196o a group of Automatic Control engineers met at the Faculty of Exact and Natural Sciences of the University of Buenos Aires and founded under the name of

CADECA (Centro Argentino de Control Automatico)

a national Organization for Automatic Control.

The first provisional Committee of CADECA was elected as follows:

Chairman:	Prof. Alberto G. DAVIE
First Vice-President:	Ing. Humberto CIANCAGLINI
Second Vice-President:	Ing. Enrique SCOTTONI
Secretary:	Dr. Mario V. TUBERT
Treasurer:	Ing. Tadeo A. HAJDUK

Members:

Ing. Emilio MARZANO	Ing. Mario E. PATRUCK
Ing. Sigfrido LICHTENTHAL	Dr. David JACOVSKY

CADECA has been admitted since as the IFAC National Member Organization for Argentine. Its adress is:

Peru 272, B u e n o s A i r e s .

Austria

The ÖAA (Österreichischer Arbeitsausschuss für Automatisierung - Austrian Committee for Automatization), National Member Organization of IFAC for Austria, has recently organized the following lectures:

On May 12, 196o (General Assembly of ÖAA under the presidence of Prof. Dr. H. H o c h r a i n e r):

"Automatization to-day and to-morrow" by Dr. W. O b u r g e r .

On June 9, 196o:

"Automation in aircraft" by Mr. A. G u n t h e r with the show of films "Bravo Alpha" and "Caravelle".

On September 22, 196o:

"Rationalisation of manufacturing by inserting machine-tools with adjustable level of automatization" by Ing. M. S c h o b e l .

Belgium

SEMINAR ON ANALOGUE COMPUTATION APPLIED TO THE STUDY OF CHEMICAL PROCESSES

Under the auspices of the As. I.C.A. (Association Internationale de Calcul Analogique) and the Applications Committee of IFAC, the Institut Belge de Régulation et d'Automatisme is organizing a Seminar to take place on the 21 - 22 - 23 November 1960, having the title:

ANALOGUE COMPUTATION APPLIED TO THE STUDY OF CHEMICAL PROCESSES

This Seminar will be organized on an international basis and will consist of papers, following by discussion, in four subject groups as shown below:

1. Simulation of kinetic and thermal problems
   - Chemical kinetics
   - Mathematical models of complex reactions
   - Simulation of physico-chemical phenomena
   - Heat exchange and transfer
2. Simulation of chemical reactors
   - Homogeneous chemical reactors
   - Heterogeneous chemical reactors (partial differential) equations)
   - Distillation columns
   - Tubular reactors
3. Automatic Control
   - Analogue computation applied to control problems,
   - On-line computers
4. Methods of operational research in the chemical industry
   - Linear and non-linear programming by analogue methods,
   - Simulation methods for optimisation studies.

Further particulars can be obtained from:

Mr. R. V i c h n e v e t s k y
President of the IBRA Committee for the application of analogue computation,

Centre Européen de Calcul Electronic Associates Inc.
43, Rue de la Science, B r u x e l l e s 4.

NATIONAL CONGRESS ON THE ECONOMIC ASPECTS OF INVESTMENT IN THE FIELD OF AUTOMATIC CONTROL AND SYSTEMS ENGINEERING

The growing interest in economic aspects of Automatic Control combined with problems of investment for creating new industries in Belgium has led the "Technologisch Instituut (Regeltechnick en Automatisatie) van de KVIV" and the Antwerp Section of IBRA (Institut Belge de Régulation et d'Automatisme, National Member Organization of IFAC for Belgium) to organize a National Congress devoted to aspects of investment within the frame work of national economy and in relation to Automatic Control and Systems Engineering.

The aim of this Congress was to make recommendations on the policy for economic expansion taking into account the investment policy followed up to now in Belgium. It took place in Antwerp on September 28 and 29, 1960.

The first part of the Congress was devoted to a survey of the present state of investment.

Besides investigation of the national investment policy followed by the Government on the one hand and of the achievements of the Provinces on the other hand, private investment and the part devoted to Automatic Control were also investigated.

On the other hand, an attempt was made to investigate, on a European scale, the influence of the Common Market on investment policy.

The first day covered general problems from the European national and industrial view points. Automatic Control and investment techniques were investigated in relation to the possibilities of future expansion.

The second day was devoted to the investigation, in committee, of problems corresponding to different industrial fields. The committees, after an exchange of views on specific problems, each prepared a short report which was submitted to the final plenary session.

LECTURES OF IBRA DURING THE ACADEMIC YEAR 1960/1961

A course of lectures devoted to:

"The part of the Controller in Controlled Processes"

will be organized by IBRA.

The Committee on Machine-Tools and Materials Handling as well as the Committee on Analog Computation Applications also plan lectures on related subjects.

France

MESUCORA

For the first time in France, an international presentation of Checking, Measuring, Control and Automatization devices and techniques will stress the importance and the mutual relationship of these different techniques in industry laboratories and research centres. On the same occasion the most recent developments and devices in theoretical and experimental research will be displayed and explained.

This international exhibition, known under the name of MESUCORA (in French, Mesure - Contrôle - Régulation - Automatisme - or, in English, Measurement - Checking - Automatic Control - Automatization) will take place, from May 9 to 17, 1961 at the CNIT (National Centre of Industry and Techniques) in Paris, under the auspices of the French Inter-Syndicate Committee on Measurement, Checking and Automatic Control.

All particulars can be obtained from:

MESUCORA, Palais du CNIT, P u t e a u x (Seine)

The address of the Press and Public Relations Department is:
4o, Rue du Colisée, P a r i s

THE 196o SYMPOSIUM ON AUTOMATIC MANAGEMENT MEANS

The 196o Symposium on Means for Automatic Management takes place in the House of the Society of French Civil Engineers, 19 rue Blanche, P a r i s (9°), from October 19 to 22, 196o. It is organized jointly by the French Computing Association, the French Operational Research Society and the French Section of TIMS.

All particulars can be obtained from the

General Secretary, 17o Avenue Paul-Doumer,
R u e i l-M a l m a i s o n (Seine & Oise).

Germany

INTERKAMA

The International Congress and Exhibition of Measuring and Automatic Control Techniques (INTERKAMA) took place in Düsseldorf from October 19 to 26, 196o under the presidence of prof. Ed. G e r e c k e (Switzerland).

Two series of lectures have been arranged as follows:

SERIES A

Oct. 2o - Control processes and Components,
Oct. 21 - New elements used for manufacturing measuring devices,
Oct. 24 - Measuring and control systems and the interpretation of measured values,
Oct. 25 - Optimal control of measured values and utilization of the results in programme control systems,
Oct. 26 - Manufacturing problems created by device techniques (part borne by metrology).

SERIES B

Oct. 2o - Physical procedures for chemical and structure analysis,
Oct. 21 - Automatic analysis methods,
Oct. 24 - Problems created by measuring and control techniques in electric power distribution,
Oct. 25 - Measurement and control of geometrical and mechanical magnitudes.

SYMPOSIUM ON VIBRATIONS

A symposium on vibrations was held on October 3 and 4, 196o in Essen by the Committee on Vibrations of the VDI.

Papers were devoted to:

- Non-linear and rheo-linear vibrations,
- Critical angular speed,
- Research on vibration phenomena,
- Technical defense against noise.

Hungary

IMEKO 1961

The participants of the International Measurement Conference held in Budapest in November 1958 decided to renew this event on a larger scale in 1961 and to add to it an international exhibition.

This Congress and Exhibition, known under the name of IMEKO 1961 will take place in Budapest from June 26 to July 1, 1961.

An international preparatory committee met in February 196o in Budapest attended by 23 delegates or observers belonging to 12 countries. This committee decided that IMEKO 1961 will not only interest itself in scientific and industrial metrology but will also in the design and manufacture of measuring instruments.

A special section will be arranged in cooperation with IFAC to take care of boundary problems of metrology and of Automatic Control.

Particular attention will be given to the organization of this section as well as to the general section on the application of electronics to measuring techniques.

Member organizations of the international preparatory committee belonging to the following countries: Austria, Belgium, Bulgaria, China, Czechoslovakia, Denmark, France, German Democratic Republic, Hungary, Italy, Poland, Roumania, Sweden, U.S.S.R., will submit proposals for papers.

The Secretariat is run by the Hungarian member organization - the Scientific Society for Measuring Techniques and Automatic Control - under the supervision of Prof. Gyorgy S t r i k e r. Its address is:

Secretariat IMEKO
P.O. Box 3, B u d a p e s t , 5.

Japan

CHIEF EVENTS

This year the 3rd National Congress, co-sponsored by seven associated societies, will be held in Osaka from November 16 to 19.

The sessions are classified in three groups: Theory, Components, and Applications. About 2oo papers are expected to be presented.

The nationwide Instruments Show is scheduled for December 196o, in Osaka.

STANDARDS OF TECHNICAL TERMS AND SYMBOLS

The Committee of Automatic Control Terminology has started its work recently under the auspices of the Ministry of International Trade and Industries.

This committee consists of members from the following academic societies: the Society of Mechanical Engineers of Japan, the Institute of Electrical Engineers of Japan, and the Society of Instrument Technology Japan.

This Committee is expected to prepare a draft for automatic control terminology in JIS (the Japan Industrial Standard).

EDUCATION

Tokyo Institute of Technology offers a course in Automatic Control since April, 196o for about 4o students.

Sweden

FIFTH INTERNATIONAL INSTRUMENTS & MEASUREMENTS CONFERENCE

This Conference was held in Stockholm, September 13 - 16, 196o. It was divided into five sections and lectures were delivered on the following general topics:

Automatic Process Control,

Physical Methods for Chemical Analysis,

Nuclear Instrumentation,

Measurements of Electric and Magnetic Quantities,

Reactor Control.

Switzerland

8th SYMPOSIUM OF ASSPA

The ASSPA (Association Suisse pour l'Automatique - Swiss Association for Automatic Control), National Member Organization of IFAC for Switzerland, held its 8th Symposium in Zürich, from September 2o to 22 196o, devoted to:

"The use of semi-conductors and magnetic circuits in Automatic Control".

Yugoslavia

ACTIVITIES OF ETAN

The Yugoslav Committee for Electronics, Telecommunications, Automation and Nuclear Engineering (abbreviated ETAN) is a professional organization of engineers and technicians, whose basic aim is to follow, study and aid the development of electronics, telecommunications, automation and nuclear engineering in Yugoslavia. It is a member organization of the Yugoslav Association of Mechanical and Electrical Engineers. In pursuits of its aim the Committee:

a) organizes professional conferences, symposia, seminars, lectures, discussions, exhibitions and other activities devoted to current problems of electronics, telecommunications, automation and nuclear engineering;

b) publishes professional and scientific papers, books and periodicals and assists other institutions in such publishing

activities which concern the problems of ETAN;

c) co-operates with government institutions and social, industrial and political organizations in all matters which concern the fields of activity of the Committee;

d) co-operates in issuing standards, specifications, laws and regulations relating to electronics, telecommunications, automation and nuclear engineering;

e) watches and studies the progress of scientific and research work in the fields of electronics, telecommunications, automation and nuclear engineering, and supports the professional training of engineers and technicians working in these fields;

f) participates in conferences,symposia and other professional meetings at home and abroad which treat problems relating to the activities of the Committee.

The Committee of ETAN represents the Yugoslav Association of Mechanical and Electrical Engineers and Technicians both at home and abroad on all questions relating to electronics, telecommunications, automation and nuclear engineering.

The M e m b e r s h i p of the Yugoslav Committee for ETAN is composed of professional committees of the Associations of Mechanical and Electrical Engineers in the Federal Republics of the Yugoslav Federation, of firms and institutions dealing with electronics, telecommunications, automation and nuclear engineering and of individual engineers and technicians who fulfill the conditions for membership in the Yugoslav Association of Mechanical and Electrical Engineers and are active in the fields of ETAN. Professional Committees in the Federal Republics are automatically admitted to membership as soon as they are set up, while institutions, firms and individuals are obliged to submit a written request for membership to the Executive Board of the Committee which decides upon each case at one of its regular meetings.

The basic activities of the Committee are carried out through commissions which are set up either for particular fields of work or for specific tasks.

The commissions are formed by decision of the Executive Board. There exist at the present the following Commissions:

- 1) Commission for electronics
- 2) Commission for telecommunications
- 3) Commission for automation
- 4) Commission for nuclear engineering
- 5) Commission for medical electronics
- 6) Commission for ultrasonics and acoustics
- 7) Commission for technical terminology
- 8) Commission for publications and propaganda
- 9) Commission for international relations

In the international field the Committee has established valuable contacts with many organizations and individuals abroad.

On behalf of the International Association of Analog Computation the Yugoslav Committee for ETAN is organizing the T h i r d I n t e r n a t i o n a l C o n f e r e n c e o n A n a l o g C o m p u t a t i o n, which is to be held in Belgrade in 1961.

The Committee is a member of the International Federation of Automatic Control.

The a c t i v i t i e s of t h e Y u g o s l a v C o m m i t t e e f o r E T A N d u r i n g t h e p a s t f i v e y e a r s have been very numerous and varied and only the most important will be summarized below.

A) S e m i n a r s

General and specialised seminars have proved to be very useful and the Committee has paid special attention to the quality of lectures and the selection of appropriate topics.

The first seminar organized by the Committee was devoted to "Application of Electronics and Radio Isotopes in Industry". The purpose was to acquaint industrial executives with the latest advances in electronics and their application in industry.

This was followed by a series of specialized seminars dealing with the following subjects.

- Servomechanisms and electronics in industry,
- High-frequency heating in industry,
- Ultrasonics in industry.

These latter seminars were of an advanced nature and were intended for specialists who had been working in the respective branches of engineering.

In 1958 a seminar on "Elements and basic Circuits of Pulse Technique" was organized for specialists working on problems of television, electronic computers and pulse techniques in general. The seminar "Application of Electronics in Medicine", acquainted doctors and medical specialists with applications of electronics in medicine and with electronic equipment used in diagnostics and therapy.

B) S y m p o s i a

The Committee has organized a series of symposia on scientific, engineering and industrial problems from which many valuable suggestions for competent governmental and industrial authorities have resulted.

The symposium on the techniques and applications of ultrasonics was attended by many specialists from industries, institutes and technical and medical colleges. Simultaneously with the symposium an exhibition of ultrasonic equipment produced by Yugoslav industry was arranged.

In 1958 the Chamber of Industries and the Committee for ETAN organized a symposium on "Automation in Industry". A number of very important conclusions regarding the future development of automation and its role in Yugoslav industry were reached at the symposium.

In 1959 a symposium on "Electronic Components" was held in Ljubljana during the International Fair of Electronics. The symposium was attended by 3oo specialists from all parts of the country who discussed 22 technical reports.

The symposium on control of quality and dimensions in metal-working industries which was held in Sarajevo in 1959 discussed all aspects of quality control in large-series production in metal-working industries. Many important suggestions on further research in this field and on the gradual introduction of automatic quality control were made.

Symposia of a special type are those which treat specific problems of industrial process control. At five such symposia, organized in 1959 and 196o, model projects were discussed for automatic process control in:

- Sugar industries
- Metallurgy
- Chemical industries
- Canning industries
- Paper industries

These symposia were attended by specialists from all industrial enterprises dealing with the respective branches and were organized in cooperation with the appropriate Associations of Manufacturers.

C) National Conference on Electronics, Telecommunications, Automation and Nuclear Engineering

The conference is of a permanent character and is held every year. It represents a convenient forum for all specialists engaged in electronics and related branches to present their scientific and technical achievements. Each of the four conferences which were held so far were attended by several hundred electronic engineers, chemists, technologists, mechanical engineers, doctors and other specialists. The 25o papers which were presented at these conferences represent a valuable contribution to the advancement of electronics and related branches in Yugoslavia.

D) Technical Studies

In the course of 1956 the Committee published a report on the State and Progress of Electronic Industry in Yugoslavia which was prepared by 15 experts from the electronic industry, the Institute for Electronics, the University and the Association of Electronical Industries. The report contains a detailed survey of the Yugoslav electronic industry as well as suggestions for the further development of this industrial branch.

Following this report, which proved to be a very valuable document, the Committee undertook to prepare another, more elaborate, report on the development and economic significance of electronics in Yugoslavia. This report, which appeared as a joint work of 6o experts from all parts of the country, and which was extended and supplemented in 1959 and 196o provides an extensive analysis of the importance and possibilities for development of the electronic industry in Yugoslavia.

In cooperation with the Post Office the Committee is now preparing a report on telecommunications in Yugoslavia.

E) Publishing Activity

The Committee has published numerous technical books, lectures for seminars, proceedings of conferences and symposia, reports and other publications.

Several members of the Committee are consultants to various publishing houses and publicity organizations and contribute regularly to daily and weekly papers and radio and television broadcasts.

United Kingdom

The British Conference on Automation and Computation

This Conference until recently has been divided into three autonomous Groups for the Engineering Applications of Automation, for Computation and Automatic Control and for the Sociological and Economic Aspects of Automation Techniques.

At meetings of the three Groups held on 1oth October, 196o, it was agreed that the Conference would operate more effectively under a central Council.

Sir Walter Puckey was elected Chairman of the Conference, with Messrs. L.T. Blakeman, J.F. Coales and H.G. Conway as Vice-Chairmen, S.M. Rix as Honorary Treasurer and W.K. Brasher as Honorary Secretary. The Institution of Electrical Engineers will provide secretarial services for the Conference.
The Council confirmed its continued support for IFAC.

PUBLICATIONS

Unesco

BIBLIOGRAPHY

At the request of the National Committee of the USSR for Automatic Control, UNESCO has published a 74-page list of 757 books on Automatic Control, 1300 copies of which were sent to Moscow, namely for distribution at the First International Congress of IFAC held from June 27 to July 2, 1960.

For this purpose, the Secretariat of UNESCO has requested information from specialized publishers throughout the world and, as a result, has received an enormous quantity of catalogues and publications which, together with the already avaible bibliography sources, have served as a basis for establishing on a large scale the requested list of books.

Professor Ing. Dr. Victor Broida, who has acted as UNESCO Technical Adviser, has perused all the avaible above-mentioned information, has selected 757 titles of books and has classified them according to a system which he has established.

We publish below the classification (which, in the published list of books, is given in English and in Russian) according to which the quoted books are listed. An authors index (in Latin and Russian alphabets) is added to this classified list.

All requests, complementary information and remarks on account of this list of books - which, of course, should be considered only as provisional and, probably, very incomplete - should be sent to:

Mrs. E. Savova
Department of Natural Sciences
UNESCO, Place de Fontenoy,
Paris 7°, (France).

CLASSIFICATION OF BOOKS ON AUTOMATIC CONTROL
AS USED IN THE LIST PUBLISHED BY UNESCO

Theory of Automatic Control:

- General Theory
- Mathematical methods
- Grapho-analytical methods
- Stability of Automatic Control systems

- Information theory
- Random process theory and statistical methods
- Theory of switching
- Cybernetics:
  a) Cybernetics, general
  b) Engineering cybernetics
  c) Bio-cybernetics

General information on Automatic Control systems:

- Automatic Control systems, general
- Feedback systems :
  a) Feedback systems, general
  b) Linear systems
  c) Non-linear systems
- Sampled-Data systems
- Discontinuous-control and relay systems

Physical and mechanical domains of application of Automatic Control:

- Pressure, flow and level instrumentation and control
- Temperature and humidity instrumentation and control
- Instrumentation and control of other physical magnitudes
- Position control
- Motion control

Automatic Control Means:

- Automatic Control means, general,
- Fluid control means:
  a) Fluid control means, general,
  b) Hydraulic control means,
  c) Pneumatic control means.
- Electric control means:
  a) Electric control means, general,
  b) Electromechanical control means,
  c) Electronic and electromagnetic control means.
- Automatic Control computers:
  a) Computers, general,
  b) Analog computers and simulators,
  c) Digital computers,
  d) Analog-digital and digital-analog conversion.
- Telemetering and telemechanics.

Applications of Automatic Control to industry, transportation and transmissions:

- Automatic Control in mining and oil-extraction,
- Automatic Heat Control,

- Automatic Power Control:
  - a) Automatic Power Control, general,
  - b) Automatic Control of combustion engines and locomobiles,
  - c) Control of steam turbines,
  - d) Control of gas turbines,
  - e) Control of hydraulic turbines,
  - f) Control of electric machines and movers.
- Automatic Process Control and design:
  - a) Automatic Process Control and design, general,
  - b) Automatic Control in metallurgy,
  - c) Automatic Control in chemical engineering and oil-refining,
  - d) Automatic Control in paper and pulp industry,
  - e) Automatic Control in sugar industry,
  - f) Automatic Control in food industry,
  - g) Automatic Control in miscellaneous industries.
- Automatic Control in machining and manufacturing,
- Automatic Control in railway techniques,
- Automatic Control in ship navigation,
- Automatic Control in aircraft,
- Automatic Control in space techniques and missiles,
- Automatic Control in transmissions.

M i s c e l l a n e o u s i n f o r m a t i o n r e l a t e d t o A u t o m a t i c C o n t r o l :

- Standards of Automatic Control,
- Terminology of Automatic Control,
- Symbols of Automatic Control,
- Patent information,
- Bibliography of Automatic Control.

INFORMATION PROCESSING

(Proceedings of the UNESCO - International Conference, 15 - 2o June 1959), to be published jointly by
UNESCO, Paris
R. Oldenbourg Verlag, München
Butterworths Scientific Publications, London.

The volume, apart from subject index and index of authors' names, contains the full text in English or French of each of the 61 papers discussed at the Conference on Information Processing together with summaries of these papers in English, French, German, Russian and Spanish, accompied by introductions and summary reports of the discussions in English or French. In addition there are summaries in English or French of the 65 lectures given in the course of the various specialized meetings.

The main chapters are:

I Methods of digital computing
II Common symbolic language for computers
III Automatic translation of language
IV Pattern recognition and machine learning
V Logical design of computers
VI Computer techniques of the future
VII Miscellaneous topics

Germany

NEW BOOKS

- "Practical formulae for the Control Engineer" (Faustformeln für den Regeltechniker")by R.W i n c k l e r. 48 p., 26 ill., DM 4.4o. Publ. by R.von Decker's Verlag, G. Schenck, Hamburg, 196o.

- "Light-sensitive components for automation" (Lichtempfindliche Bauelemente für die Automatisierung") by P. G o e r c k e, 312 p., 131 ill., DM 3o.--, Publ. by R.von Decker's Verlag, G. Schenck, Hamburg 196o.

- "The transducer, one of the building-stones of Automation" ("Der Transduktor, ein Baustein der Automatisierung") by W. K a f k a, 14o p., 111 ill., DM 15.--, publ. by von Decker's Verlag, G. Schenck, Hamburg 196o.

- "Automatik Katalog 196o", edited by Ed. G e r e c k e and O. S c h ä f e r, 2.Edition 196o, DM 9.5o. Publ. by Max Binkert GmbH, Frankfurt/M., 21.

Switzerland

- "New Techniques" , N° 9, 196o, publ. by Verlag Neue Technik, Zürich 4.

This number includes reports on IFAC and the Moscow Congress as well as a revised draft of the Graphical Symbols for Automatio Control which has been published by prof. Ed. G e r e c k e in IFAC Information Bulletin N° 6.

United Kingdom

NEW TECHNICAL PUBLICATION

A new publication "Electronics Weekly" is being launched in newspaper format, complementary to the already established monthly technical journal "British Communications and Electronics", by: Heywood & Company Ltd., Russell Street, Drury Lane, L o n d o n W.C. 2.

USSR

BOOKS ON AUTOMATIC CONTROL (in Russian)

The following 39 books on Automatic Control have been or are to be published by the Academy of Sciences of the U.S.S.R.

A l l o r d e r s s h o u l d b e s e n t t o :

Office "Akademkniga"
Department "Postal orders for books"
Bolshoy Tcherkassky pereulok 2/1o
M o s c o w (Center)

- "Automation". Selection of articles translated from English. About 16o pages, 3 roubles (to be published)
- "Automation of machine-building processes" Volume 1 : Hot metal-working. 394 pages, 23 roubles, 1959.
- "Automation of machine-building processes" Volume 3 : Automation of machining processes and general problems of automation. About 53o pages, 24 roubles (to be published).
- "Automatic Control, Telemechanics, Instruments" Issue n°3. Commented index of publications. About 8o pages, 2 roubles (to be published).
- "Automatic Control". About 48o pages, 23 roubles (to be published).
- "Automation of production processes". Issue n°2. 178 pages, 9.1o roubles, 1958.
- "Automation of production processes". Issue n°3. About 16o pages, 7 roubles (to be published).
- I.I. Artobolevski. "Theory of mechanisms for the construction of plane curves". 255 pages, 13.8o roubles, 1959.
- A.A. Bulgakov. "Energetic processes in electric drives under harmonic operation. About pages, 3.5o roubles (to be published).
- M.L. Bychovski. "Fundamentals of dynamic accuracy of mechanical and electrical circuits". 158 pages, 7.5o roubles, 1958.
- B.I. Verkhovski. "Application of radioactive isotopes for checking production processes", 84 pages, 1.25 roubles, 1959.
- "Problems of pneumo-hydro-automatics". About 24o pages, 11 roubles (to be published).
- "Problems of synthesis and accuracy of complex continuously-acting devices" 227 pages, 12.5o roubles, 1958.
- N.S. Gorskaya, I.N. Krutova, V.Iu. Rutkovski. "Dynamics of non-linear servomechanisms". 319 pages, 16.6o roubles, 1959.

- L.I. Gutenmacher. "Electronic information-logical machines". 189 pages, 3 roubles, 196o.
- L.A. Zalmanzon. "Flow elements of pneumatic measuring and Automatic Control devices". About 25o pages, 11 roubles (to be published).
- G.P. Katys. "Some problems of Automatic Control of non-stationary fields". About 18o pages, 8 roubles (to be published).
- G.P. Katys. "Elements of non-stationary flow Automatic Control", 212 pages, 8.4o roubles, 1959.
- V.S. Kulebakin, V.D. Nagorski. "Semi-conductors in Automatic Control". About 16o pages, 3 roubles (to be published).
- M.S. Liebkind. "Controlled reactor for A.C. transmission lines". About 18o pages, 8 roubles (to be published).
- V.L. Lossievski, A.G. Pliskin. "Problems of automation of continuous production processes". About 1oo pages, 4.5o roubles (to be published).
- A.G. Mamikonov, "Automation of oil extraction" 66 pages, 1 rouble, 1958.
- D.Iu. Panov. "Automatic translation". 7o pages, 1.1o rouble, 1958.
- V.A. Petrov, "Basic theories of Automatic Control of Motor Car drives". 164 pages, 9.9o roubles, 1957.
- "Problems of information transmission". Issue n°6. About 16o pages, 7 roubles (to be published).
- "Industrial telemechanics". 286 pages, 18.55 roubles, 196o.
- V.N. Roginski, "Elements of structure synthesis of relay control circuits". 168 pages, 9.75 roubles, 1959.
- "Transactions on Automatic Control and Telemechanics" (Proceedings of the 2nd and 3rd Conferences of young experts of the Institute of Automatic Control and Telemechanics) 287 pages, 12.95 roubles, 1956.
- "Transactions on Electromechanics". Issue n°4. Electric machines, electric drives, electric traffic using A.C., automatized electric drive of a telescope, automatic control and instruments. About 24o pages, 11.5o roubles, (to be published).
- "Conference of the Academy of Science of the U.S.S.R. on scientific problems of automation of the production, 15 - 2o October 1956". Volume 1. Plenary sessions. 272 pages, 13 roubles, 1957.
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- "Conference of the Academy of Sciences of the U.S.S.R. on scientific problems of automation of the production, 15 - 2o October 1956" Volume 7. Complex automation of production processes. 312 pages, 15 roubles, 1957.
- V.A.Taft, "Problems of theory of electric circuits with variable parameters and synthesis of pulse and digital Automatic Controllers". About 1oo pages, 4 roubles (to be published).
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- A.V. Khramoi. "History of the development of Automatic Control in the USSR" (Period before October 1917), 222 pages, 12 roubles, 1956.
- "Digital analogs for Automatic Control systens", About 16o pages, 8 roubles (to be published).
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NOTE ON INFORMATION BULLETIN No. 9

The Information Bulletin No. 9 is expected to be published in January 1961. Information to appear in this issue should therefore reach the Editor:

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Boulogne-sur-Seine (Seine) France

not later than December 15, 196o.