An Important Treatise of Industrial Cybernetics

Having appeared in the fifth decade of our century, cybernetics was defined at the beginning as the comparative study of automatons we find in technics and in beings. Of course, the idea of such a comparative study is not new if we refer to the qualitative aspect. In fact, centuries ago, Descartes considered the animals as automatons and later La Mettrie spoke about the man-machine. But, towards the end of the fourth decade of our century, a mathematical quantitative theory of automated adjustment systems was elaborated. The indisputable merit of Noerbert Wiener, founder of cybernetics in the present acceptation consists in the very application of the automated adjustment theory in biology.

Gradually, the cybernetic sphere has by far surpassed the biological. An economic cybernetics, a neurocybernetics, a cybernetics of industrial systems was thus set up.

Recently, the literature of speciality was enriched with a valuable volume entitled "Initiation into the Cybernetics of Industrial Systems" brought out by the Technical Publishing House, in the series "Automatics, Informatics, Electronics, Management". Its author is professor, dr. eng. Ştefan Bîrlea, head of the specialized department of the Bucharest Polytechnic Institute.

The work is unique in our literature of speciality and the ideas presented by the author in this treatise are the outcome of many years of documentation and thinking, both in his teaching work and in his contact with production and with the highest decision-making forums in our country.

It must be shown from the very beginning that as part of the contemporary scientific and technical revolution, the management and organization of modern industrial systems imply the working out and systematization of new systemic, cybernetic principles.

What characterizes the present monograph is the introduction of new original concepts into the cybernetics of jump flow systems,

such as the systems in the engineering industry. Generally, the work combines a very modern mathematical apparatus with concrete applications of the analysis of real situations.

It should be pointed out that the author's viewpoints were announced at various international congresses of speciality where they enjoyed success.

Professor, dr. engineer Ştefan Bîrlea has introduced some new conceptions pertaining to the systems theory into the study of industrial systems. Thus, we mention in the first place the operatorial description of the systems. Generally, a cybernetic structure is defied by certain fundamental operators. These operators describe the management activities of the internal adjustment, production and traffic system to which we should add the very important operator characteristic of the scientific, technical and operational activities.

This last operator is of particular importance in industrial cybernetics because it is an element of intense multiplication directly influencing the modernization of production and its competitiveness on the market.

Confining ourselves to the major problems introduced by the author, we mention his original conception about the estimation of the level of organization of the systems. The author has elaborated the concept of *entropic condition.* The entropic condition is the general characteristic of the cybernetic systems of containing, inside them, perturbations opposing the finalization of the aim of the respective systems.

Were there no perturbations, the proposed aim would be attained with no deviations and each effectual element would have a functioning probability equal to the unit. This is the case of the ideal systems which, obviously, are abstract. Any real system is subject to the action of perturbations.

The author considers that it is entropy which can measure the organizing level of a system. He admits that the size of the entropic condition of a cybernetic system is in keeping with its entropy, respectively, the quantity of information concerning the internal perturbations contained by it.

It we now pass on to the examination of the way in which the work is structured, we notice that it is made up of three parts and eight chapters.

The first part deals with the general problems of the relationship between cybernetics and the management of industrial activity. It is pointed out that in the present stage, scientific management is a demand of modern industry. It is also pointed out how the industrial activity can be dwelt on from the systemic point of view. The cybernetic conception of industrial management is presented.

It naturally passes to the cybernetic concepts and methods used in the analysis of industrial activity. The general systems, the cybernetic and the cybernetic-economic systems are characterized. We mention the following definition: "A cybernetic-economic system is a set of

elements in inter-action (comprising men and machines) integrated in fulfilling an established objective, by the handling and control of materials, energy, information and human activity".

As we pointed out, prof. Ştefan Bîrlea describes the cybernetics of industrial systems by certain operators. The present monograph underlines the properties of these operators and it also dwells on the problem of operator algebras.

Considering the major role attributed to entropy, the problem of information and entropy in the cybernetic-industrial systems is examined.

The problem of the adjustment and self-adjustment of the cybernetic-industrial systems is also examined. The function of efficiency of the industrial systems is being defined.

Naturally, the role incumbent on the model in the cybernetics of industrial systems is examined.

The second part deals with the elements of calculus with cybernetic operators for the industrial systems. Among the fundamental operations examined, we mention: homology, equivalence, the reunion of systems, the product of systems, the limit of a row of systems, the homomorphism of systems, the scheduling of systems.

Setting out from the definition of the entropic condition, it examines the ergodicity of the cybernetic-industrial systems and the relations between the fundamental operators of the cybernetic-industrial systems.

The monotony of the systems, the decomposition of the unit operator, etc are being examined.

A chapter of the work is devoted to the aggregation of the cybernetic-industrial systems. The irreducible industrial structure is the place of work. From the cybernetic point of view, it is there that the first aggregation of the three fundamental elements of production is achieved: manpower, means of production and the objects of labour. The group of installations, the technological line, the workshop, the section is further examined and it passes to the aggregation of the complex industrial structures.

The complex industrial structures by cybernetic methods are further analysed. The problem of selfadjustment is approached both in relation to the external factors and to the internal factors and in conditions of temporality.

The multivariable industrial structures in the method of the condition variables are analysed.

The third part deals with the cybernetic interpretations of the modern concepts of industrial management. The various types of management are thus examined, such as: participative, previsional, on the basis of objectives, by exception, systemic.

A special chapter deals with the cybernetics of the fundamental attributes of industrial management. Thus, the cybernetics of forecast, the cybernetics of organization, the cybernetics of co-ordination and the cybernetics of control are analysed.

The last chapter is a general view of the achievment of cybernetic systems for industrial management. It outlines the relations between the information systems, the informatic systems and the cybernetic systems for industrial management. The relationship between cybernetic management and the optimization of the functioning of industrial systems is outlined. It also studies the correlation between the management micro and macrosystems as well as the principles of carrying out the cybernetic systems for management.

The work comprises a rich reference material.

The monograph "Initiation into the Cybernetics of Industrial Systems" by prof. dr. eng. Ştefan Bîrlea is an extremely valuable work, both from the theoretical and applicative points of view. Many examples facilitate the understanding of the fundamental aspects.

The work is useful to those concerned with cybernetics, especially to those who have any connection with industrial cybernetics.

Prof. dr. eng. Edmond Nicolau