

volume. Basic concepts of instrument display and design are explained in a lucid manner. It is apparent that controversial issues are developing rapidly, and there is a great need for more fundamental research along these lines. In this respect, the topics introduced by the various specialists in aviation medicine and psychology point out shrewdly the future trends. Anyone concerned with instrument design outside the aviation industry might well take heed of these aspects of human engineering which have a universal application.

The papers devoted to anthropometry indicate the impetus given to statistical work of this nature by aviation in general. In the man/aircraft combination, the work space is critical, and approximately one-third of the book is devoted to this subject, which includes a large-scale survey of body measurements carried out in the French Air Force. Research and applications carried out for the Royal Air Force are summarized in an excellent manner and point out to the engineer his responsibility in this field.

The third part of the book, dealing with related subjects, is essentially the general medical application of the previous concepts to aviation. For example, a paper on somatotyping by P. M. van Wulfften Palthe (Netherlands) usefully supplements the French statistical survey. It is suggested that anthropometric studies may be linked with psychological profiles drawn up by air-crew selection boards according to the principles developed by Kretschmer and Sheldon. Altogether, the book should arouse wide interest and appeal to many not directly concerned with aviation.

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SERVO-MECHANISMS AND CONTROL SYSTEMS

Engineering Cybernetics

By H. S. Tsien. Pp. xii+289. (London: McGraw-Hill Publishing Company, Ltd., 1954.) 46s. 6d.

WHEN a new book arrives on my desk nowadays, I am always hoping that it may not be yet another book on servo-mechanisms and control. Usually it is the mixture as before: a few hackneyed phrases to be written about the ever-growing need for more automatic control in industrial processes; the need for a sound mathematical background; the wide interpretations of the concept of feedback; the accelerated growth of a new science, etc. For the market is flooded with books on the subject. When I saw the title of the volume under notice, "Engineering Cybernetics", my fears were roused, and I must admit to approaching the work with a sense of irritation and in an antagonistic mood. The author has done himself a great disservice in choosing such a misleading means of introducing his book; for a glance at the contents and the preface shows it to be confined strictly to the field of mechanism, making no reference to biological matters or sociological affairs.

But if the title was a frightening thing, the contents were a soothing balm—for this book turned out not to be the same old medicine. Regarded strictly as a text upon the theory of servo-mechanisms and control systems, and nothing else, it is honest and excellent. A great deal of material will be found which is not readily available, to my knowledge, in

any other collected form. It can be recommended to the attention of fairly advanced students of servo-mechanism theory, feedback and control processes. In his preface the author excuses the title on the grounds that it denotes "... an engineering science, whereas servo-mechanism engineering is an engineering practice [italics his]. . . . No gadget is mentioned". But I protest: gadgets are mentioned. The book is full of them—diagrams and sketches of springs and dashpots, amplifiers and air-foils, relays and rockets; and a good thing too, for such intellectual prudery is quite out of place. Further, one excellent point of this volume is the great number of fully worked examples—really practical ones.

The author has succeeded well in presenting the essential mathematical techniques, methods and concepts, with explanations and illustrations drawn from a great variety of engineering mechanisms. The introductory sections perhaps serve little purpose, being bare facts about Laplace transforms, lists of operations, and rapid surveys of the mathematical elements; this is a fault which seems very common in many American text-books of this type. Either the reader must know his elements already or he must study them seriously, and at laborious length; he will gather little understanding from the sort of distillations so frequently seen. But this book very soon gets down to work. After a few chapters presenting what is by now the classical treatment of feedback mechanisms, more modern material is introduced. Systems with several controlled quantities are studied, with their interactions; and the need for new stability criteria is considered, with representation of such system behaviour by transfer-function matrices. A small criticism is that several electrical engineering terms, such as 'carrier', 'filter', are used without explanation. Would not a few words help mechanical engineers?

Systems having statistical inputs are taken next, after a good introduction to random process theory: averaging, correlation, power spectra, moments. Then relay servos are treated, their stability being examined by a modification of the well-known Nyquist criterion. This continuity of concept, with extension as proves necessary, is a most commendable policy adopted here. The student can hang on to reality a long while in terms of his existing mental images; and it becomes very clear when, and why, such images fail utterly and must be abandoned.

The work continues with the general properties of non-linear systems, and then with systems having variable coefficients, at which point the classical transform approach must be abandoned. Later chapters deal with the design of specific systems by perturbation theory; here, almost the entire work centres around one class of practical problem—the design of guided missiles to follow prescribed trajectories, or to seek a prescribed target—and the author reveals his own specialization. This problem is carried to great lengths, and includes allowance for the effects of atmospheric variations, for missile manufacture tolerances, etc. Both analysis and synthesis are studied.

There is a good deal of valuable descriptive material, besides the formal mathematics, in this book, giving some notion of purpose, of design difficulties, reasons for choice of methods and other matters so commonly omitted from such books—perhaps not being understood by the theoreticians writing them. But I would beg the author to change the title before a second edition.

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