

NONLINEAR OPTIMISATION, by L. C. W. Dixon, Crane, Russak & Co., 1972, 214 pp.

REVIEWED BY RICHARD E. MAINE¹

This book is a good introductory survey of optimization techniques. Although certainly not written for the specialist, it presents a basic outline of the field suitable for an undergraduate engineering course or an engineer unfamiliar with the subject. Examples are abundant and are used to motivate most developments.

The book's strong point is its presentation, in a fairly integrated manner, of several topics usually treated separately. The "static" problem of minimizing a function of n variables is discussed in the first section. Some mention is made of most of the basic techniques of unconstrained optimization, including Newton-Raphson, gradient and direct search methods. Constrained problems are discussed, emphasizing Lagrange multipliers and penalty functions, followed by a brief review of some topics in mathematical programming. In the second section we see an introduction to the "dynamic" problem of finding an optimal path. The basic ideas involved in the Calculus of Variations, Pontryagin's Maximum Principle and Dynamic Programming are presented in an easily understood manner.

As should be obvious from the spread of topics considered in one fairly short book, the presentation is rather shallow. There is, for instance, little detailed discussion of convergence properties, excepting a few heuristically based comments. The author does compare different methods and discuss some of the pitfalls, but in specific problems other considerations may enter that result in different conclusions. The assumption is made that anyone interested in more detail will be able to find it elsewhere in the voluminous literature of the field.

Keeping in mind the audience intended, the lack of depth does not detract too much from the book, and the breadth of the coverage adds quite a bit. I would recommend it highly to someone interested in an overall picture of the concepts of optimization.

¹Optimization Software, Inc., Los Angeles, Calif.

MANKIND AT THE TURNING POINT, by Mihajlo Mesarovic and Eduard Pestel, E. P. Dutton and Co., Inc., 1974, 210 pp.

REVIEWED BY STEPHEN L. RICE¹

The Club of Rome, a distinguished international grouping of academicians and industrialists, has since 1968 fostered the study of "the world problematique." This grand problem is manifest as an unprecedented tangle of global crises: energy, food, raw materials, population. The first report to The Club of Rome, based on Forrester's world simulation model, was published in 1972 under the title *The Limits to Growth*. Although heralded as a doomsday prophecy, criticism was moderated as the energy crisis hit home.

Mankind at the Turning Point is the second report to The Club of Rome, and is based upon an extension of the simulation underlying the projections of *The Limits to Growth*. In this extension, professors Mesarovic and Pestel and their co-workers have developed a multilevel model of the world system. The detailed structure of this model is (understandably) not presented in the book; however, the following significant features are described. First, rather than treating the world as a homogeneous unit, ten geographic regions are defined on the basis of their internal commonality. Second, each region is described in terms of its physical,

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ecological, technological, economic and social characteristics (roughly 100,000 stored relationships).

Third, the model is conversational; the analyst provides reactive inputs along the entire continuum of the future projection. Fourth, most projections are based on a fifty year increment; this allows for slow dynamic effects, such as changes in fertility patterns due to planned population policy in a given region. Fifth, although based on ten geographical regions, the model is capable of producing data characterizing units smaller than a region, i.e., a single sovereign state. With this capability, the model is offered as a policy planning instrument for decision makers.

In application, the model is employed to study alternate sequences of possible events and sociopolitical choices termed *scenarios*. Those presented in the book include the following: (1) the effects of time delay in the amount of developmental aid required to reduce the per capita income gap between regions of the world, (2) the effects of time delay in implementing effective fertility controls, (3) the effects of various pricing structures, export policies and reactive measures between regions of production and consumption of oil, and (4) the effects of alternative approaches to the world food problem.

In the outcome of most scenarios, the penalty for delayed action (or inaction) is immense in terms of human suffering, and, in terms of dollars. The authors maintain, furthermore, that our current crises are not temporary, and that solutions cannot be obtained in a framework of independent states. Instead, the authors argue forcefully for global and regional cooperation on a scale heretofore unknown, and a significant restructuring of human attitudes toward organic interdependent development of all societies.

While the details of alternative scenarios and of the methodology (not presented in the book) are arguable, the primary thrust of the multiple messages are not. This work should be required reading for politicians and decision makers throughout the world.

REGULATION AND CONTROL IN PHYSIOLOGICAL SYSTEMS, Edited by A. S. Iberall and A. C. Guyton, International Federation of Automatic Control, 1973, cloth, 11.75 × 8.25 in., 607 pp.

REVIEWED BY MARY F. SHAFER¹

This volume contains the proceedings of a conference held in August, 1973. It covers a number of physiological topics including the cardiovascular, respiratory, nervous, and renal systems, metabolism, endocrinology, and other topics in biochemical processes. There are twenty one chapters, each with a commentary and, on the average, six papers.

I read all 153 commentaries and papers in this volume and have formed some definite impressions about physiological systems. It seems that without strongly defined physical laws, as are frequently present in engineering problems and solutions, it is extremely difficult to postulate a model with much generality. Considering this, I thought this volume very interesting, containing a highly varied selection of topics. It makes obvious the great difficulties facing those working in physiological systems. Bearing these difficulties in mind, my impressions of the drawbacks, from the engineering view, follow.

It appears that physiology is mostly a random collection of facts, hypotheses, and opinions, based on a startling variety of experiments. In this volume experimental subjects included bats, cats, rats, frogs, dogs, mice, chickens, sheep, calves, and humans. Further, there is no certainty of interspecies correlation.

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- Club of Rome (1974). Mankind at the Turning Point. In my previous article, The First Global Revolution, I described the two most well-known reports published by the Club of Rome. In The Limits to Growth (1972) they conclude that "the earth is facing an imminent catastrophic collapse if human civilization continues on its current trajectory." The second report produced by the CoR in 1974 was titled Mankind at the Turning Point. This report develops further the concept on the World Problematique they introduced in The Limits to Growth. They state that "the world is facing an unprecedented set of interlocking global problems, such as, over population, food shortages, non-renewable resource depletion, environmental degradation and poor governance."