POLYMER COATINGS

Polymer Coatings in Nuclear Technology

By V. B. Tikhomirov. Translated from the Russian. Pp. x+204. (Israel Program for Scientific Translations: Jerusalem. Distributed by H. A. Humphrey, London, 1968.) 110*s*.

THIS is an interesting book described by the author as intended for scientists and technicians employed in plants, institutes and blue-printing units of nuclear and other industries. It is intended for use as a reference book on polymer coatings and will be found useful by students in chemical, engineering and other institutes. The book itself consists of three parts: (1) utilization of polymer coatings in nuclear industry; (2) main types of polymer coatings; and (3) fundamental properties and fields of utilization of polymer coatings.

Set out in this way, there is inevitably a considerable amount of rather tedious repetition of the areas of application for polymeric coatings in the industry and an abundance of rather obvious "cautions" particularly in the first section. There is, however, much useful information in the last two sections.

The first of these covers the various types of polymer coatings including epoxies, polyesters, PVC, polyethylene, organo-silicon, phenolics, furylics, polyurethane and a material called "ftoroplast" which is described as the Russian equivalent of polyfluoroethylene. This section covers quite well the various chemical reactions and areas of application for the different coating systems.

The final section deals with particular requirements for coatings, such as resistance to corrosive liquids, thermal resistance, ability to withstand radiation and electrical properties. Many tables and graphs are provided which compare the properties for particular applications of the different types of coatings previously discussed in the second section.

Although the tables and figures are good, the book is poorly illustrated and the subject matter of the photographs is not well chosen. It is on the whole a useful reference book, but its price is high. The book was originally published in 1965 and there are few references later than 1963, which means inevitably that certain sections are rather out of date.

W. A. HOLMES-WALKER

PROBLEM SOLVING

Quasilinearization and Invariant Imbedding

With Applications to Chemical Engineering and Adaptive Control. By E. Stanley Lee. (Mathematics in Science and Engineering, Vol. 41.) Pp. xvii+329. (Academic Press: New York and London, 1968.) 140*s*.

THIS book is an attempt to give a simple exposition of the principles of quasilinearization and invariant imbedding and the numerical application of these techniques to the solution of practical problems. The first chapter introduces quasilinearization and invariant bedding and contrasts these with the classical techniques for solving boundary value problems. It also contains a very brief account of the numerical solution of differential equations.

In the second chapter, quasilinearization is discussed in detail and its relationship with the Newton–Raphson method is explored. The finite difference technique for the solution of boundary value problems is also described. These computational procedures are applied in chapter three to the solution of a number of ordinary differential equations arising in chemical reactor theory, and stability and convergence are discussed. Generalization to systems of differential equations is then indicated and some of the computational difficulties are stressed.

Parameter estimation by means of least squares minimization is the subject of the fourth chapter. Again the use of quasilinearization results in efficient numerical procedures and a number of examples from chemical engineering and automatic control theory are solved.

An important source of numerical two-point boundary value problems occurs in the application of the calculus of variations and the maximum principle of Pontryagin to optimal control theory. In chapter five, quasilinearization is applied to such problems and the techniques are illustrated by application to optimum temperature and pressure profiles in chemical reactors.

The formal theory of invariant imbedding is developed in the sixth chapter and some simple illustrative numerical examples are given. The connexions between invariant imbedding and dynamic programming are also pointed out. In the following chapter a number of computational algorithms which combine quasilinearization and invariant imbedding are described and it is shown how quasilinearization can be used in the dynamic programming approach to optimization. Chapter eight continues with an account of the use of invariant imbedding in nonlinear filtering theory.

The final chapter is concerned with the use of quasilinearization in the formation of computing algorithms for the solution of parabolic partial differential equations. Applications are given to a number of problems arising in the study of chemical reactor dynamics.

Two very brief appendices conclude the book. The first states a selection of results from variational theory and the maximum principle; the second discusses the gradient method in function space.

One criticism of the book is that the background mathematical knowledge required by the reader would seem to be rather more than that suggested by the author. For example, it is unlikely that those scientists and engineers—in this country at least—likely to read this text would be familiar with maximum principles in differential equations. Another criticism is that the numerical examples are all relatively simple, and where guidance for more complicated systems is given it is rather tentative and seems not to be based on extensive experience of the numerical solution of such systems.

Despite these criticisms, however, I warmly recommend the book to anyone interested in the numerical solution of boundary value problems. In particular I should like to see more of our young mathematical research workers take up this extremely stimulating branch of mathematics with its combination of analytical and numerical techniques.

C. STOREY

Obituaries

Professor L. G. Vinogradov

PROFESSOR LEV GRIGORIEVICH VINOGRADOV, who died suddenly of a coronary occlusion in Moscow on November 14, was a well known marine biologist, born in Moscow in 1909. In 1927 he entered the University of Moscow where he graduated in invertebrate zoology. From 1931 to 1950 he was a research hydrobiologist at the Pacific Institute of Fisheries and Oceanography in Vladivostok where he eventually became head of the Hydrobiological Laboratory. During the Second World War he served with the coast artillery in the Far East as a battery commander. In 1950 he moved to Moscow to the All-Union Institute of Fisheries and Oceanography as a senior naturalist and later was promoted to head of his laboratory. At the same time he was the leading consulting fishery biologist for a project for exploitation and biological reconstruction of the Caspian Sea.

As an undergraduate Vinogradov began his work on

decapod crustaceans and eventually became an authority on this subject. He contributed much to the taxonomy and zoogeography of the Far Eastern marine decapods (partly in collaboration with Professor J. A. Bierstein), but his most important achievement was to elucidate the natural history of the Kamchatka king crab (*Paralithodes kamtschatika*). Some of his findings, both biological and economical, were used as the basis of a successful crab fishery in the Far Eastern Seas. As well as his work on the crab, Vinogradov investigated the feeding grounds of bottom fishes during the Bering Sea Expedition in 1958–62, when with Dr A. A. Neyman he studied the bottom communities of the flatfish feeding grounds. In the Caspian Sea, Vinogradov investigated possible means of improving the trophic condition of fish involving, for example, the construction of high dams across the rivers and changes of sea level.

Because he was concerned chiefly with commercial fisheries, Vinogradov did a great deal of consulting and organizing work on all kinds of national and international committees. Outside biology his chief interest was philately.

Correspondence

Generalized Degrees

SIR,—The reports by Swann[1] and McCarthy[2] and the article by Pippard[3] have raised the question of generalized degrees.

Whenever industry is discussed, it is rare to find any mention of agriculture and, in respect of generalized degrees, I am tempted to wonder how many people are familiar with the efforts already made in agricultural teaching at university level. I would therefore like to present a picture of the degree courses in agriculture at Reading, not because they are perfect or necessarily better than others, but because they are the outcome of several years of detailed study and because I think that in them we have solved some of the problems which are now being talked about.

Basically, there is a pass course starting with a preliminary year followed by parts I and II, and an honours course which starts with part I and goes on to part II and then part III. Thus each course lasts three years and parts I and II are identical for the two courses.

The advantage of the preliminary year, which consists of botany, chemistry, geology, physics and zoology, with exemptions from any subject which has been passed satisfactorily at A-level, is that it enables us to take students whose A-level subjects are not of the right kind or are not quite up to a certain standard. Thus a student with arts subjects is not debarred from this preliminary year. Another advantage is that, at the beginning of part I, the students who have taken the preliminary year are roughly similar in attainments to those taken into the part I course on the basis of A-level results.

The part I course, like all other "first year" courses at Reading, lasts two terms only, starting in October. The agriculture student studies four principal topics, namely, animals, plants, agricultural systems and economics, plus a course in statistics, and he is examined towards the end of the Easter vacation. Each of the four sections contains a great deal of applied science, but every item in the syllabuses has been looked at in its relations to all the others.

Part II starts in the summer term and, being free from examinations in that term, the student has the full summer, autumn and lent terms for study and is practically free in the second summer term of the part II course to prepare for the second examination, which starts about four weeks after the beginning of term. The four principal subjects studied in part II are crop production, animal production, management and economics and agricultural engineering, using the basic information of part I as a foundation. In all appropriate subjects there is a mixture of theoretical and practical work, the latter taking the form of laboratory and field work or both.

This structure forms the basis of the claim that the course is general and provides that mixture of sciences, applied sciences, economics and management which so many think is desirable. At this stage the pass student ends his course, with a good general knowledge of agriculture and a wide background of other subjects.

The student taking the honours course, and who has exactly the same background, now selects one of the four subjects which have formed the basis of his studies so far. Thus in part III he studies in greater depth the one "subject", although all specialists still study a group of subjects common to all options, namely, comparative agriculture, food and communications (use of library, etc.).

Students who take these courses are strongly motivated towards, and also have practical experience in, agriculture. Further, now that the course is so closely integrated, graduates are considered suitable not only for the obvious posts in agriculture and branches of agricultural technology but also for posts in market research and management consultancy and as management trainees in business organizations.

In addition to the courses specifically mentioned, Reading has highly specialized honours courses in agricultural botany, agricultural economics, physiology and biochemistry of farm animals and soil science; thus the faculty has a large staff of specialists who also teach their own discipline to the students of agriculture.

Planning these courses took several years of detailed discussion and brought together staff from all departments. This cooperation continues in boards of studies, each covering one of the four groups of subjects, and regular meetings of the chairmen of these boards also keep the whole degree under review and prevent unbalanced developments by one or other of the boards.

I do not wish to suggest that teachers in other subjects in other universities have not done similar things, but I felt it worthwhile to indicate that we think we have made some contribution which could be of help to those dealing with other subjects, and who are thinking of more generalized and more integrated degrees.

Yours faithfully,

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[1] *Rep. Working Group on Manpower for Scientific Growth*, Cmd. 3760 (HMSO, 1968).
[2] McCarthy, M. C., *Science Policy Study No. 3* (HMSO, 1968).
[3] Pippard, A. B., *Nature*, **219**, 1307 (1968).

University News

Professor L. Cranby, University College of South Wales, Cardiff, has been appointed to the Sir Jesse Boot chair of organic chemistry in the **University of Nottingham.**

Dr A. H. Jarrett, Queen's University, Belfast, has been appointed director of the **Boyden Observatory** near Bloemfontein and professor of astronomy at the **University of the Orange Free State.**

Dr A. J. Willis, Bristol, has been appointed to the chair of botany in the **University of Sheffield.**

Mr J. Merriman, Post Office Telecommunications Headquarters, has been appointed as visiting professor in the Department of Electronic Science and Telecommunications in the **University of Strathclyde.**