classified by some anonymous wit as "angels", really did have wings.

Future practitioners may appreciate this book, with its reasonably clear enunciation of radar principles and practice and its summary of the few score of original papers that have appeared to date. Until recently one might have wondered whether there would be many such people. High power, long-range radar equipment is far too expensive for ornithologists and the showers of angels were an obscuring nuisance to the prime users of the sets. Technical advances could soon have resulted in their elimination. Modern aircraft, however, are showing an increased tendency to collide with birds, so a new and economically important interest has arisen as to where birds are flying. A radar watch for migratory concentrations may therefore become a standard requirement for airport controllers. But the majority of airstrikes are on military aircraft streaking along below radar cover, or on take-off and landing, so one should not, perhaps, have too high hopes that ornithologists of the future will have access to a regular mine of photographic records of migrations in progress.

They will have to be dedicated men. While the speeded up cine film of a radar display is alive and exciting, the individual frames are deadly dull, as witness the many plates adding substantially to the high cost of this book. To the uninitiated they are just one lot of "damned dots" after another. Nor are the attempts to represent them in diagrammatic form much happier. Dozens of little maps sprinkled with tiny arrows give more the impression that hostilities have broken out in the Channel and that Harold is again in danger of personal disaster. To be fair, radar studies of migration are not alone in having failed to achieve an attractive form of presentation. The compilations of visual records from bird observatories, plastered with endless synoptic charts, have set a high standard of boredom. Indeed, this may be the reason for one of the main lacks in this book; there is no thorough-going attempt to relate radar findings (many of which are not novel) with the information obtained by other methods of studying migration.

Perhaps more emphasis should have been laid on the crucial weaknesses of the radar method, the inability to describe, other than in very broad categories, the numbers or the kinds of birds involved in the choirs of "angels". It is said that specific identification of the "signatures" of radar echoes may be possible for single birds at short distances. Sadly, those seeking to follow up the reference to the (10 cm) radar detection of pulsations in the pectoral muscles of a small passerine will not find it published in the *Proceedings of the International Ornithological Congress* as specified (or anywhere else for that matter). The reference list also omits a number of relevant publications in ornithological journals, but does usefully give some papers in technological offerings that would not normally come the way of the ornithologist.

The book is well produced and free from typographical mistakes.

G. V. T. MATTHEWS

WAVEGUIDES IN THEORY

The Theory of Waveguides and Cavities

By R. A. Waldron. Pp. xiii+120. (London: MacLaren and Sons, Ltd., 1967.) 32s. net.

Theory of Waveguides and Cavity Resonators

By Emile Argence and Théo Kahan. Pp. xv+424. (London and Glasgow: Blackie and Son, Ltd., 1967.) 120s. net.

ALTHOUGH the two books which form the subject of this review bear almost the same title, this is practically the only common factor between them. The first text, by

Richard Waldron, has as its core a number of papers published by the author in 1961. It is essentially intended for research workers studying waveguide boundary value problems or the theory underlying the measurement of dielectric or ferrite properties using cavity resonators.

In the introductory chapter the concept of the HSP (homogeneous-simple-perfect) waveguide is presented and its properties are reviewed. Later the author proposes that a 1:1 correspondence exists between modes in non-HSP and HSP guides. Although no general proof is given the proposition does appear to be borne out by experience. In Chapter 3 the author argues strongly that in approaching a new non-HSP waveguide problem one should seek to identify modes with those of the HSP guide. The fourth chapter sets out the author's views on mode nomenclature with illustrations drawn from the behaviour of circular waveguide containing an axial dielectric rod. Chapter 5 attacks the concept of surface impedance when used in the determination of the complex propagation coefficient of a mode in a waveguide with imperfectly conducting walls. Undoubtedly Waldron's point is valid, but it would be instructive to have a comparison made with an exact rather than perturbation solution of the non-HSP waveguide problem. With present day computers this is quite feasible, and could form a valuable study. Chapter 6 presents a critical derivation of the formula for the determination of the complex permittivity and permeability of a small sample introduced into a resonant cavity. The next chapter extends perturbation theory to include waveguides. After a derivation of the static expressions for fields in small ellipsoids, the final chapter makes a careful appraisal of cavity methods of measuring ferrite properties.

Although Waldron's style of writing will not appeal to all, there is something to be said for "black and white" statements in a monograph of this kind. Undoubtedly some readers will be stimulated to make their own examination of the problems described.

The second book, a translation from the French, was specially prepared for science faculty students obliged to study on their own. So far as British students are concerned, however, the treatment is such as to appeal principally to those graduates in mathematics or theoretical physics who have an interest in electromagnetic problems. There is a nine chapter mathematical introduction which, in part, aids understanding of the sixteen chapters dealing with electromagnetic fields, waveguides and cavities which follow. The introduction includes three quite substantial chapters on the theory of distribution which I did not find to be essential to my understanding of the main work of the book. The section on the electromagnetic field contains an account of Mie's analysis of diffraction by a dielectric sphere and the integral equation method of Levine and Schöninger, applied to the same problem. The section on waveguides commences with a treatment of plane wave propagation in a dispersive absorbing medium, which is followed by a review of basic circuit theory. A general theory of propagation in waveguides is then considered and results for specific waveguides follow. If thus far a certain incoherence in treatment seems apparent, this impression is probably justified. From the remaining chapters those describing the modal analysis of source excited waveguides, due to Felsen and Maserutry, and the application of radiational methods are noteworthy. The whole book really comprises a selection of topics in electromagnetic theory intended for the advanced student. The treatment is essentially mathematical with rather sparse physical descriptions; however, the originality of approach may appeal to those having reasonable familiarity with the subject matter. In places the presentation of important subjects is terse, whereas elsewhere a student with mathematical competence could easily follow the steps.

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