FD(N, L)

$= A(N, L, n + 2)$ [(3.15), (3.17)]

$= E(D^n(N), A(N, L, n + 2))$ [(3.15), (3.11), (3.13)]

$= E(D^n(N), FD(N, S(L)))$ [(3.18)]

$= E(S(L), FU(N, S(L)))$ [(3.2), (3.3), (3.24)]

$= E(S(L), C(N, S(L), n + 1))$ [A2.6]

$= E(S(L), H(S^{n+1}(L), C(N, S(L), n)))$ [A2.5, (3.14)]

$= E(S(L), H(S^{n+1}(L), FU(S^n(L), S(L))))$ [(3.19)]

$= H(S^{n+1}(L), E(S(L), FU(S^n(L), S(L))))$ [(3.21)]

$= H(S^{n+1}(L), E(S(L), FD(S^n(L), S(L))))$ [(3.24)]

$= H(S^{n+1}(L), E(D^{n-1}(S^n(L)), A(S^n(L), L, n)))$ [(3.2), (3.18)]

$= H(S^{n+1}(L), A(S^n(L), L, n+1))$ [(3.13), (3.11)]

$= H(S^{n+1}(L), FD(S^n(L), L))$ [(3.17)]

$= H(S^{n+1}(L), FU(S^n(L), L))$ [(3.24)]

$= H(MU(N, L, n+2), C(N, L, n+1))$ [(3.14), (3.19)]

$= C(N, L, n+2)$ [A2.5]

$= FU(N, L)$ [A2.6]

Thus we have established the identity

$$FD(N, L) = FU(N, L) \text{ for } (N, L) \epsilon K_{n+1}$$

and by the induction the identity is valid for $(N, L)\epsilon K_p$, where p is a non-negative integer.

References

COOPER, D. C. (1966). The equivalence of certain computations, *Computer Journal*, Vol. 9, pp. 45–52.

MCCARTHY, J. (1962). Towards a mathematical theory of computation, *Proc. IFIP*, Munich Conference, Amsterdam: North Holland Publishing Co., pp. 21–28.

STARK, R. H. (1968). On means to record algorithms to facilitate generation of error-free programs, WSU Computing Center Report, 68–1.

Book Review

Field Computation by Moment Methods, by Roger F. Harrington, 1968; 225 pages. (New York: *Macmillan Co.*, £5 12s. 0d.)

Let L be a linear operator and suppose that f has to be found so that

$$Lf = g$$

where g is known. By expanding f in terms of known functions $\{f_n\}$ so that $f = \Sigma\alpha_n f_n$ where the α_n are constants to be determined we can write $\Sigma\alpha_n Lf_n = g$. Then, if an inner product $\langle\, ,\, \rangle$ is available, we are led to

$$\sum_n \alpha_n \langle w_m, Lf_n\rangle = \langle w_m, g\rangle$$

where the w_m are conveniently chosen functions. The matrix equations determine the α_n and hence f, or an approximation to f if f is not in the space spanned by the f_n. This is what the author calls the moment method.

The author's aim is to show that the moment method is the basic tool in computing numerical solutions to a large number of problems in electromagnetism. His way of doing this is by means of copious illustrations and explanation. He does not attempt to give rigorous proofs or theorems.

The first chapter has a clear account of the moment method together with some elementary examples. An indication is given of how the operator L may be extended so that the f_n may be more conveniently chosen. The relation between the moment and variational methods is briefly mentioned.

The next 5 chapters are concerned with applications drawn from electrostatics (both conductors and dielectrics), two-dimensional electromagnetic fields on conductors and dielectrics, the impedance of a wire antenna, the generalised network parameters of bodies and multiport systems.

The remaining 4 chapters deal with cases when g is expressed in terms of f so that eigenvalues have to be calculated. The examples used are cylindrical waveguides, cavity resonators and the optimisation of antenna systems.

Each chapter ends with a list of references giving details of the work described. In some ways this is the most valuable feature of the book because the average reader will find it difficult to decide how best to choose the w_n and f_n for a problem not covered by the examples. The author's view is that this comes from experience but the reader ought to be made aware that not every choice of f_n gives convergence to the required solution and that some matrices are more ill-conditioned than others (I think that the author is a little too optimistic about the ability of modern computers to handle all kinds of matrix).

Those readers who want a very readable description of many of the computing techniques that have been tried in field problems will find this an excellent reference (there are no exercises) though they may wish for more detailed and critical analysis of the possible alternatives. It is a pity that the book is so expensive that it will not be read as widely as it deserves.

D. S. JONES (Dundee)