corrector and Runge-Kutta methods and points out special situations like stiff systems. The essentials of both least squares and Chebyshev approximation are presented and the importance of orthogonal functions and Chebyshev polynomials, resp., is well explained. The "classical" chapter ends with a section on approximation by rational functions.

Chapter 3 distinguishes this book from virtually any other in the field. Of course, numerical Fourier analysis does appear in most books, but only as one of many ways of approximation in the "time" domain whereas the "frequency" domain is hardly ever considered. The basis of Hamming's treatment is the "aliasing" effect of equidistant sampling which makes higher frequencies appear in the disguise of lower ones. This idea permits a new and often very natural appraisal of sampling distances in general when it is extended to nonperiodic functions by the consideration of the Fourier transform, and it also provides an interesting comparison with the polynomial error theory of Peano's theorem. It makes it natural to attempt a minimization of the error in the frequency domain which yields new types of formulae. While smoothing, filtering and similar subjects are treated at length, an explicit discussion of attenuation factors is strangely missing. Of course, the fast Fourier transform appears prominently. A section on the quantization of signals concludes this chapter.

Two short chapters follow. The one on exponential approximation discusses the characteristics and pitfalls of the approach; Prony's method is suggested for the determination of unknown exponents. The author then gives a short introduction to the Laplace transform; finally, he discusses some of the inherent problems of simulation, again emphasizing the frequency approach. The last chapter presents the author's view of some unrelated subjects: Numerical treatment of singularities, nonlinear optimization, and eigenvalues of Hermitian matrices. Two more "philosophic" sections, on linear independence and on general aspects of scientific computing, round up the heavy volume.

It may be difficult to use the book as a text for a course on numerical mathematics: Math majors may miss the formal rigor, science students may shun some of the mathematics, beginning computer adepts will not appreciate the wisdom of the author's remarks and more advanced ones may be deceived by the elementary looking treatment. Nevertheless, the book is a must for everybody teaching numerical mathematics at any level to any audience: There is hardly a subject in the field on which such a person will not find some new stimulation for his teaching job. And for those whom Hamming is addressing directly—scientists and engineers with numerical computing needs and some computing experience—the book is probably the best there is.

J. S.

17 [**2.00**, 3, 4].—THE OPEN UNIVERSITY, *Course Books,* Harper and Row, New York, 1973.

In 1969, The Open University (United Kingdom) received its charter to bring higher education into the private home. It uses radio, television, specially written correspondence material, cassettes and tapes, residential summer schools and local study centers. The readings and assignments are carefully coordinated with the BBC's broadcasts.

In Mathematics, there are four courses so far: Foundations (36 units), Linear Mathematics (33 units), Elementary Mathematics for Science and Technology (17 units), Mechanics and Applied Calculus (16 units). As an illustration, here are the topics in the Linear Mathematics course: vector spaces, linear transforms, Hermite normal form, differential equations I, eigenvalues, recurrence relations, numerical solution of $Ax = b$, homogeneous differential equations, Jordan normal form, non-homogeneous differential equations, linear functionals and duality, bilinear and quadratic forms, affine geometry and convex cones, inner product spaces, linear programming, least-squares approximations, convergence, numerical solution of ODE's, Fourier series, wave equation, orthogonal and symmetric transformations, boundary value problems, Chebyshev approximation, theory of games, Laplace transforms, numerical solution of eigenvalue problems, differential equations II (resonance), heat conduction, existence and uniqueness theorems.

With each unit comes a 50-page paperback booklet whose style reflects the absence of teaching assistants, office hours, and discussion sections. There are plenty of exercises, lots of pictures, and, what is most striking, frugality in the exposition. This last comment is intended to be a compliment: often a text presents too many results and the student is given no perspective on them. In these booklets, the key facts are set down clearly, with proofs where appropriate. Frequent use is made of summaries and glossaries.

The units appear to be excellent for self-instruction, and sell for about $3.00 each. The prerequisite structure of units within each course is indicated pictorially on the cover. However, these units are not always self-contained. Two specified texts (from the U.S.A.) are needed for the Linear Mathematics course.

The unit on Chebyshev approximation, for example, has three sections: best polynomial approximations, Chebyshev polynomials and Chebyshev series. Subsections on the Remez algorithm and the computation of Chebyshev coefficients are optional. This unit is almost entirely independent of the two textbooks, whereas the Fourier series unit is essentially a commentary on one of the textbook's treatment of the subject.

There are films supplementing each unit: $125 for black and white, $275 for color. The cassettes were priced at $7.50 each.

Britain's experiment in higher education without a campus will probably be watched with apprehension by academics and with keen interest by state legislators.* The idea does seem particularly relevant to adult education and retraining.

B. P.

18 [2.00, 3, 4, 5, 6, 8, 12].— GERMUND DAHLQUIST & ÅKE BJÖRCK, translated by NED ANDERSON, *Numerical Methods,* Prentice-Hall, Inc., Englewood Cliffs, N.J., 1974, xviii + 573 pp., 24 cm. Price $15.95 (clothbound).

This is a remarkable textbook as well as a handbook for scientific computation. It is filled with well-written, succinct descriptions of methods and algorithms, together with mathematical analyses, practical observations, splendid exercises, and references to the literature for more detailed treatments. The scope of the topics (as indicated in the chapter headings that are listed at the end of this review) is greater than I would have thought to be feasible in a volume of this size. Nevertheless, the authors succeed admirably. The verbiage is kept to a minimum, so that it is easy to find clear explicit descriptions of the methods. This feature should make it possible to use the work as a handbook and as a text in an undergraduate numerical methods course, where the emphasis is on learning how to solve problems, rather than on the mathematical analysis

* No riots, no panty raids, no library.