ill-conditioned problems, besides the task of solving Abel equations.

The book is strongly recommended for those working in the theory or the applications of integral equations. Thus it should be suitable for graduate students in science or engineering as well as for their teachers.

F. S.

4[01A55, 01A70, 68–03].—MICHAEL LINDGREN, *Glory and Failure: The Difference Engines of Johann Müller, Charles Babbage and Georg and Edvard Scheutz*, The MIT Press, Cambridge, MA, 1990, 414 pp., 26 cm. Price $45.00.

As the result of exhaustive, painstaking research, this copiously annotated, well-illustrated book presents a detailed social and technical analysis of the first attempts to mechanize the production of numerical tables.

The book is divided into two parts. The first begins with a survey of the most celebrated numerical tables published before 1830. This is followed by the history and technology of the difference engines (so designated by Charles Babbage) and accompanied by biographical sketches of their inventors. The first of these men, Johann Müller, invented in 1784 a printing tabulating machine 37 years before Babbage first considered such a device. Müller and his machine, which was never built, have been almost completely ignored by previous historians. In contrast, the lives and inventions of Charles Babbage, Georg Scheutz and his son Edvard have been well documented in the existing literature, which is referenced in an appended bibliography of nearly 400 sources.

The second part contains a detailed comparison of Babbage's Difference Engine No. 1, as planned but never completed, with the third difference engine of the Scheutzes. Babbage's failure to fully implement his plans is attributed to his perfectionism and his initial limited knowledge of engineering. Despite their achievement of completing three operational difference engines, Georg and Edvard Scheutz failed to attain commercial success because of the mathematical limitations of their machines and the limited market for machine-computed and typeset tables. In the Epilogue the assertion is made that if the Scheutzes had been more attuned to market forces and had concentrated on building ordinary calculating machines, their fortunes would have been assured.

In an appendix the author describes his rediscovery in 1979 of the first Scheutz engine, which had been stored away in its case and forgotten among the collections in the Nordic Museum in Stockholm for nearly a century. Details of the restoration of this machine preparatory to its display are included by the author, who participated in that task.

Apart from a number of typographical errors resulting in misspellings, this reader has detected only one significant error, which arose from the confusion of James Glaisher with his son James Whitbread Lee Glaisher, to whom all relevant references in the text should have been made. This error of identification extends to the index of persons, where (on page 411) the dates given for the son are actually those of the father. The correct chronological entry should read (1848–1928).

This carefully written, scholarly book is an impressive addition to the MIT Press series on the History of Computing. It will be rewarding for all those

interested in the development of the precursors of the electronic digital computer.

J. W. W.

5[65–06, 70–06, 76–06, 93–06].—RENATO SPIGLER (Editor), *Applied and Industrial Mathematics*, Mathematics and Its Applications, Vol. 56, Kluwer, Dordrecht, 1991, xiii + 374 pp., $24\frac{1}{2}$ cm. Price $136.00/Dfl.220.00.

These are the proceedings of a symposium on Applied and Industrial Mathematics held October 2–6, 1989, in Venice, Italy. Part I contains the invited papers, Part II selected contributed papers.

The invited speakers and their titles are: C. Cercignani, "Physical problems and rigorous results in kinetic theory"; A. Chorin, "Statistical mechanics of vortex filaments" (abstract); Feng Kang, "The Hamiltonian way for computing Hamiltonian dynamics"; C. W. Gear & Fen-Lien Juang, "The speed of waveform methods for ODEs"; J. B. Keller, "Diffusively coupled dynamical systems"; Peter D. Lax, "Deterministic turbulence" (extended abstract); J. L. Lions, "Exact controllability for distributed systems. Some trends and some problems"; V. P. Maslov, "Beginning of weakly anisotropic turbulence"; Sanjoy K. Mitter, "Markov random fields, stochastic quantization and image analysis"; H. Neunzert, F. Gropengiesser & J. Struckmeier, "Computational methods for the Boltzmann equation"; J. R. Ockendon, "A class of moving boundary problems arising in industry"; M. Primicerio, "Systems with non-fading memory encountered in the modellization of industrial problems"; Mario Pulvirenti, "A stochastic particle system modelling the Broadwell equation"; A. Quarteroni & A. Valli, "Theory and application of Steklov-Poincaré operators for boundary-value problems"; S. Rionero & B. Straughan, "On the problem of natural convection".

The contributed papers are grouped under six subject areas: Mathematical modelling in fluid mechanics; Nonlinear waves; Wave propagation in random media; Transport phenomena; Inverse problems in the applied sciences; Mathematical modelling of industrial problems.

W. G.