SHORTER NOTICES

Integrationsmethoden der Lieschen Theorie. By Dr. Gerhard Kowalewski. (Mathematik und ihre Anwendungen, Volume 15.) Leipzig, Akademische Verlagsgesellschaft, 1933. viii + 221 pp.

The author restricts himself to a relatively small number of topics, which he treats with considerable detail and illustrates with numerous well-selected exercises. He gives the same brilliant treatment and employs the same stimulating style evidenced in his earlier work: *Einführung in die Theorie der kontinuirlichen Gruppen*, Volume 9 of the same series. (For a review of this book, see this Bulletin, vol. 40 (1934), p. 20.)

There are only two chapters. In the first and much the longer one, the author considers ordinary differential equations invariant under r-parameter groups and methods for solving such equations. He develops the theory of invariants of r-parameter groups and brings out their use in the problem of solving differential equations invariant under such groups. He emphasizes clearly the importance of Lie's determinant Δ, and later extends the use of this important tool by introducing the *mixed* Lie determinant. Numerous well-chosen illustrative exercises aid one greatly in following the theory. He does not confine himself to Lie's treatment of these important topics, but gives an account of his own work and that of his students, either in detail or by reference to the literature.

In the second chapter the author confines himself to the study and use of Lie's integrating factor (first announced by Lie in 1874) for an ordinary differential equation, invariant under a one-parameter group, and to an extension of this idea to systems of ordinary differential equations of the first order.

The book is decidedly a valuable addition to the available literature on the topics treated.

ABRAHAM COHEN

Application des Imaginaires au Calcul Vectoriel. By J. B. Pomey. Paris, Gauthier-Villars, 1933. vi+70 pp.

The subtitle is "Complément à la Conférence sur le Calcul Vectoriel." This course, given at the École Supérieure d'Électricité, deals in part with the use of complex numbers in vector analysis. The book under review furnishes material for this part of the course. The author gives various applications of complex numbers to geometry, kinematics, alternating currents, elliptic vibrations, and the method of symmetric coordinates of Fortescue. There is also a discussion of Cayley's formula, which sets up a correspondence between the bilinear transformation of the complex plane and the rotation of a sphere about a diameter. The book is carefully written and the treatment in several places is somewhat unusual. It makes stimulating reading for the mathematician and gives some notion of the kind of mathematics used in electrical engineering.

C. A. SHOOK