CALCULUS OF FINITE DIFFERENCES.

Differenzenrechnung. Von A. A. MARKOFF, O. Professor an der kaiserlichen Universität zu St. Petersburg. Autorisierte deutsche Uebersetzung von THEOPHIL FRIESENDORFF und ERICH PRÜMM. Mit einem Vorworte von R. MEHMKE, O. Professor an der k. technischen Hochschule zu Stuttgart. Leipzig, B. G. Teubner, 1896. 8vo, iv + 194 pp.

THE number of books devoted exclusively to the calculus of finite differences has been comparatively few since its introduction as a branch of mathematics by Brook Taylor in his Methodus Incrementorum in 1715 and the publication of the first systematic treatise thereon by François Nicole in 1717. Perhaps one reason for this is the fact that the principles and theorems of the subject which are most frequently required in practical work are simple and can be proved when occasion for their use arises as, for instance, in interpolation and in the summation of series. The only works in English on finite differences now obtainable are Herschel's appendix to the translation of Lacroix's Differential and Integral Calculus published in 1816, which was followed by Herschel's Collection of Examples in 1820 ; the Calculus of Finite Differences incorporated in his volume on Differential Equations by John Hymers in 1839 which reached a second edition in 1858 ; the articles on finite differences in De Morgan's great work on the differential and integral calculus which appeared in 1842 ; and Boole's treatise which was published in 1860 and was intended as a sequel to his Differential Equations. A second edition of Boole's Calculus of Finite Differences, revised by J. F. Moulton, appeared in 1872. The latest works with which Professor Markoff's volume may be compared are Boole's treatise and Schlömilch's Theorie der Differenzen und Summen which was published in 1848.

Professor Markoff's work is characterized by a higher degree of generality in the theorems and greater thoroughness and rigor in the reasoning than is found in the writings of his predecessors. At the same time, his treatment is somewhat dry and severe, is rather too condensed at times, and is far from being as genial, interesting, and philosophical as that of Boole. The treatises of the two authors may be regarded as complementary. An important difference between their works is that Professor Markoff scarcely uses symbolic formulæ and eschews the symbolic method which was created by Lagrange and Laplace, and developed and employed