

upon here with a critical pen are to be regarded as trivial when compared with the work as a whole. In the hands of a teacher who will supplement the exercises of the text with more of those illustrative of the older methods on the one hand, and who will drill his students vigorously in reckoning with Lie's fundamental operator, the infinitesimal transformation, until they acquire facility in forming commutators,\* on the other, the book is fully capable of realizing its double object of introducing the beginner† to two of the widest and most fruitful domains of mathematics—the theory of continuous groups and the theory of differential equations.

The mechanical make up of the book is up to the standard of the Macmillan press. A few trivial typographical errors will not escape the careful reader; the most flagrant probably is the occurrence of three in two consecutive lines of the preface.

The list of mathematical text-books in English is being continually and wisely augmented by the publications of The Macmillan Company, but with all that is good in the new, American students would welcome re-edited reprints of the classic volumes of Boole in the field of differential equations.

EDGAR ODELL LOVETT.

PRINCETON, N. J.,  
24 February, 1898.

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### SHORTER NOTICES.

*Annuaire pour l'An 1898, publié par le Bureau des Longitudes.*  
Paris, Gauthier-Villars et Fils.

One or two alterations which have been made in the *Annuaire* for the current year call for mention. A few of the more technical astronomical details concerning variable and double stars and small planets have been omitted, while the

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\* This term has been suggested as the equivalent of Lie's *Klammerausdruck* to represent the operation  $(U_1 U_2) f \equiv U_1 (U_2 f) - U_2 (U_1 f)$ , where  $U_1 f$  and  $U_2 f$  are two infinitesimal transformations; its use would have spared numerous circumlocutions in the text.

† The reader will observe that in the above opinion the writer takes exception to one advanced in *Nature* (current volume, 10 February, 1898), where the usefulness of Page's book as an introductory volume for beginners is questioned. No text-book can supply both text and teacher. In the hands of an instructor who is alive to both sides of the subject the book is susceptible of successful application to the needs of those studying the subject for the first time.

elements of those periodic comets which have been observed during part of a single revolution only, have been transferred to the *Connaissance des Temps* for 1900. New magnetic charts and elements for France have been inserted and the scientific information generally is brought up to date.

There are five appendices. MM. Loewy and Puiseux write on the progress made by the aid of photography in our knowledge of the surface of the moon; M. Poincaré considers the stability of the solar system; M. Cornu describes the scientific achievements of Fizeau; M. Janssen records the work done at the Mont Blanc Observatory during 1897; and the orations delivered by MM. Janssen and Loewy at the 50th anniversary of M. Faye's admission to the Academy are given in full. As usual these notices are clearly and simply written and thoroughly interesting, but only one calls for special remark here, namely, that of M. Poincaré.

M. Poincaré points that all the efforts made to demonstrate the stability of the solar system have been of the nature of successive approximations, the demonstrations being constructed for fictitious planets whose motions approach more or less closely to those of the solar system. It is doubtful, however, even if we restrict the problem by neglecting tidal action and the effects that are possibly produced by a resisting medium, whether the system would be really stable. The mathematical expressions for the motions show that the latter are periodic in their nature, but it is not known for what extent of time these expressions will be available. M. Poincaré draws the distinction, necessary in this connection, between a very long time and an infinite time. The results show that the motions are stable in the former case, if not in the latter. But when we consider the parts played by these other forces, the ultimate stability seems doubtful. The tides alone, whether liquid or elastic, will tend to make the whole system rotate as one rigid body, but the presence of a resisting medium, however slight—and one can hardly doubt that such a medium exists—will continually accelerate the mean motions and diminish the mean distances. One by one the planets will fall into the sun and the final state will be a single body at rest relatively to the medium which surrounds it.

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