An Introduction to the Lie Theory of One-Parameter Groups: With Applications to the Solution of Differential Equations of Differential Equations

Abraham Cohen

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From the PREFACE.

The object of this book is to present in an elementary manner, in English, an introduction to Lie's theory of one-parameter groups, with special reference to its application to the solution of differential equations invariant under such groups.
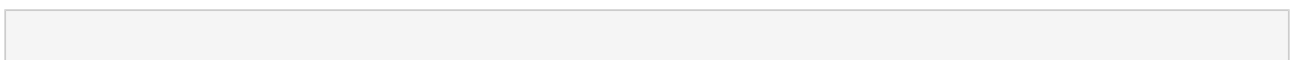
The treatment is sufficiently elementary to be appreciated, under proper supervision, by undergraduates in their senior year as well as by graduates during their first year of study.

While a knowledge of the elementary theory of differential equations is not absolutely essential for understanding the subject matter of this book, frequent references being made to places where necessary information can be obtained, it would seem preferable to approach for the first time the problem of classifying and solving differential equations by direct, even if miscellaneous, methods to doing so by the elegant general methods of Lie ; and this book is intended primarily for those who have some acquaintance with the elementary theory. To such persons it should prove of great interest and undoubted practical value. An attempt has been made throughout the work to emphasize the role played by the Lie theory in unifying the elementary theory of differential equations, by bringing under a relatively small number of heads the various known classes of differential equations invariant under continuous groups, and the methods for their solution. Special attention may be called to the lists of invariant differential equations and applications in §§ 19, 28, 30; while the two tables in the appendix include most of the ordinary differential equations likely to be met.

Only as many examples involving the solution of differential equations as seem necessary to illustrate the text have been introduced. The large_ number usually given in the elementary textbooks seems ample for practice.

The short chapter on contact transformations, while not essential to the work, has been added for purposes of reference and to give the student sufficiently clear ideas, so as to provide a working knowledge, in case he has occasion to apply them. For the same reasons, the rather sketchy note on r-parameter groups has been added, where an attempt is made to bring out, as concisely as seems consistent with clearness, the relations between r-parameter groups and their infinitesimal transformations. An exposition of the general theory would be beyond the scope of this work.

To a large extent Lie's proofs and general mode of presentation have been retained, both because of their elementary, direct character, and because the subject is so essentially Lie's own. An attempt has been made, however, at a more systematic arrangement of the subject matter and at identifying more closely the classes of differential equations invariant under known groups with those considered in the elementary theory.

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