

Hyperbolic Problems — Aachen 1988

The Second International Conference on Hyperbolic Problems will be held in Aachen on March 14–18 1988. Significant advances have been made in the last few years in the exact and approximate solution of systems of nonlinear hyperbolic equations and their applications. The aim of the conference is to bring together scientists in the field for a presentation of recent results and to discuss future research. Further information can be obtained from:

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International Conference on Radicals — Sapporo, Japan

An international conference on “Radicals — Theory and Applications” is to be held in Sapporo from July 24 to 30, 1988. Further information can be had from:

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Book Reviews

ATLAS OF FINITE GROUPS by J.H. Conway, R.T. Curtis,
 S.P. Norton, R.A. Parker and R.A. Wilson
 Clarendon Press, Oxford, 1985, xxxiii+252pp. ISBN 0-9-8531990

The classification theorem for finite simple groups, which was completed around 1980, stated that a finite non-abelian simple group is an alternating group of degree at least 5, a group of Lie type, or one of the 26 sporadic groups.

The first priority of the authors of the Atlas is to print the ordinary character table of as many of these groups as possible since it is their view that this is the most compendious way of conveying information about a group to a skilled reader.

With the infinite families their guideline was “to think how far a reasonable person would go and to go one step further”. Thus A_{13} is the largest group considered in the alternating series. A group of given Lie type is specified by two parameters, rank and field size. For low rank a variety of field sizes may be shown while for the highest rank only the smallest field size is shown. For example, the character tables of $PSL(2, q)$ are shown for $q \leq 32$, while for rank 4 only that of $PSL(5, 2)$ is shown. All of the sporadic groups are included.

In addition to the ordinary character table the authors present information about the maximal subgroups (nearly always complete), the Schur multiplier, the outer automorphism group, the character table for the corresponding covering groups and extensions by automorphisms (in most cases), as well as various constructions of the simple group or a near relative.

The book has A3 format pages and is spiral bound. The introduction, pages i to xxxiii, consists of eight chapters in which the simple groups are described and explanations are given on how to read the tables and text in the two hundred and fifty two pages of the main body of the Atlas which follow.

The authors seek to reinforce trends in notation that they see as desirable. One of these is Artin's convention that single letters are used for groups that are ‘generally’ simple, for example, $L_n(q)$ for $PSL(n, q)$, and $S_{2n}(q)$ for $PSp(2n, q)$. This can lead to some confusion, for example, $U_n(q)$ for

$PSU(n, q)$. The chapter on the classical groups is a model of conciseness and comprehensiveness.

I felt the introduction is marred in places by notations being used before their definition. For the expert this poses no problem, but for the neophyte it means that the introduction may have to be read several times.

How accurate is the information in the Atlas? I quote the authors

"Any complacency we might have had in this regard was rudely shattered when the pre-publication version of the table for the outer automorphism group of the Held group was found to contain an error affecting 22 entries (but obeying the orthogonality conditions)!"

Still, the existence of the Atlas means there can be an agreed starting point for the correction of errors. This together with the existence of the alternative CAS system of Neubuser, Pahlings and Plesken augurs well for the hope of completely correct tables in the near future. The next step would seem to be the production of tables of modular characters, at least for the sporadic groups, and I believe this project is already well under way.

This book is a must for everyone interested in finite groups. Most obviously it collects in one place an enormous amount of information on many of the most important groups. It can accommodate users of various levels of sophistication. It can be used to answer simple questions about, for example, orders of centralizers and numbers of conjugacy classes of elements of the same order or more sophisticated questions about, for example, the possible subgroups a set of elements might generate or about characters of the covering groups. Though only groups of Lie type for low rank and smallish field size are included, these are often surprisingly typical of their families and so can be good pointers in the framing of conjectures about their families.

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THE SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS

by the late E. L. Ince and I. N. Sneddon FRS

Longman Mathematical Texts, Essex, 1987, 234 pp. St.£8.95

ISBN 0-582-44068 8

This book is a welcome edition to the excellent Longman series of Mathematical texts. In it Professor Sneddon has re-presented and extended the material covered by the late E. L. Ince in his 1939 book published by Oliver and Boyd. The aim of the book is "to provide in a compact form an introduction to the methods of solutions of ordinary differential equations for students of mathematics". This book certainly achieves that aim, although I feel that it provides more than an introduction.

The book begins by considering equations of first order and degree, and in 42 pages presents (a) motivation, (b) a discussion on uniqueness and existence, (c) a discussion on various classifications, and (d) some classic equations. This material of this chapter is presented very concisely and clearly. Examples are used very effectively to illustrate all important principles. One almost feels that if this chapter were expanded that students who understood every detail would already be well on the way to having a good introduction to ordinary differential equations.

Chapter 2 discusses Integral curves. I felt that there could have been more discussion of qualitative solutions, and in particular phase-plane solutions and stability. In Chapter 3 equations of higher degree are discussed, and well presented and Chapter 4 discusses equations of second and higher orders, but one might prefer to see the material of these two chapters presented at a later stage of the book. Chapter 5 discusses linear equations and covers a wide variety of material including Laplace transforms and Green's functions. I thought that the section on Green's functions was very clear and gave a good introduction to a topic that many students find difficult. There is an Appendix on Laplace transforms which covers all that is necessary for this chapter. In Chapter 6, solution in series is considered and Bessel functions and Legendre polynomials are covered in some detail. Chapter 7, while short, covers the basics of Linear systems of equations. The book includes some 375 problems, together with solutions, and interestingly they are not included at the ends of chapters but as a group.

In summary I would recommend that most mathematicians should have this book on their shelves. Any minor faults with the book are due to limitations of space, but I do feel that it was a pity that not even a brief discussion of numerical solution of differential equations was not included, although I am aware that this omission was probably deliberate.

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RIA PROCEEDINGS

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PROBLEM PAGE

Editor: Phil Rippon

First, here is a very pretty problem, which I heard about from Tom Laffey. It appeared in the International Mathematical Olympiad 1986 at Warsaw, and was the hardest problem set, in terms of the total scores of all candidates on individual questions. Nevertheless, several candidates solved the problem and an American student, Joseph Keane was awarded a special gold medal for his solution.

1. To each vertex of a regular pentagon, an integer is assigned in such a way that the sum of all five integers is positive. If three consecutive vertices are assigned the numbers x, y, z respectively and $y < 0$, then the following operation is allowed: the numbers x, y, z are replaced by $x + y, -y, z + y$ respectively. Such an operation is performed repeatedly as long as at least one of the five integers is negative. Determine whether this procedure necessarily comes to an end after a finite number of steps.

Next, a problem from John Mason at the Open University, who says that it is known in Maths. Education circles as the Krutetskii Problem. I have also seen it attributed to Lovacz.

2. A finite number of petrol dumps are arranged around a racetrack. The dumps are not necessarily equally spaced and nor do they necessarily contain equal volumes of petrol. However, the total volume of petrol is sufficient for a car to make one circuit of the track. Show that the car can be placed, with an empty tank, at some dump so that, by picking up petrol as it goes, it can complete one full circuit.

John Mason also asked the following apparently much harder problem. I am not aware of any reference to this problem in the literature.

3. The petrol dumps are arranged as in Problem 2, but this time the total volume of petrol is sufficient for two circuits of the track. Can two cars be placed, with empty tanks, at the same dump so that, by picking up petrol as they go, they can each complete one full circuit in opposite directions? (The cars may cooperate in sharing petrol from the dumps.)