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Michel Hervé
Université Pierre et Marie Curie-Paris

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Patterns and waves: The theory and applications of reaction-diffusion equations, by Peter Grinrod. Clarendon Press, Oxford, 1991, ix+237 pp., $39.95. ISBN 0-19-859692-8

Patterns and waves by Peter Grinrod deals with the mathematical techniques that can be applied to nonlinear parabolic partial differential equations. Much of the treatment deals with the semilinear parabolic equation

$$U_t = \Delta u + f(u, \nabla u, x, t)$$

where $x \in \Omega \subset R^n$, Ω is an open subset, and $f: R \to R$ is some smooth function and represents the reaction term. Additional boundary conditions are imposed on $\partial\Omega$, the boundary of Ω. Also $u(x, 0) = u_0(x)$ is specified. The boundary conditions considered are of (i) Dirichlet type, (ii) Neumann or no-flux type, and (iii) Robin or mixed type. For example, in the dispersive behavior of populations or concentrations, u represents the density function, Δu represents the diffusion term, and f represents the net creation or destruction rate of particles at $x \in \Omega$ at time t. While the continuous case is described in the main part of the text, the stochastic process is described in boxes that give ample directions to the interested reader for further study. The text is suitable for well-prepared senior college level or beginning graduate students. The boxes describe material that is at the current research level and will be suitable to researchers in the field. There is an adequate number of examples that are clearly solved using current techniques and the solutions are well illustrated through phase-plane plots, bifurcation analysis, and excellent computer graphics. I found this text to be an excellent introduction to the current research topics of semilinear parabolic partial differential equations or reaction-diffusion systems.

Some comments about the flow of topics in this treatment is in order. The first three chapters deal with the basic topics of conservation laws, equilibria and linear stability, traveling waves, local existence and blowup, local bifurcation analysis, transition layers, and plane waves. Chapters 4 and 5 give excellent introduction to current research topics such as geometric theory for spirals, scrolls, stationary spiral waves, toroidal scroll waves, chemotaxis, and the physical problems in physiology, biology, and chemistry. The treatment is clear, concise, and takes the reader from the beginning material to research topics in a well-illustrated, skillful manner. It was a joy for me to spend a few weeks reviewing this text. I hope to dig deeper into its contents very soon. I recommend this text to everyone, who is interested in the subject of semilinear parabolic partial differential equations. I would like to thank Professor Peter Grinrod for treating such a difficult subject in a very clearly illustrated and interesting manner.

G. S. GILL
BRIGHAM YOUNG UNIVERSITY

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Algebraic curves over finite fields, by C. J. Moreno. Cambridge University Press, Cambridge, 1991, ix+246 pp. $49.50. ISBN 0-521-34252-X

Confessions of a reviewer. Reviewer to himself. Great! I am glad to have been asked to review Moreno's book. Now that I will have two copies, I can keep one at home and one at the university. I will have to read it and thus hope that my first glance of it, in which the first chapter seemed too difficult, was deceptive. After all, it should be just up my street with a background in classical algebraic geometry and the combinatorics of finite projective spaces. Also, since I have been giving expository talks for some years on the Hasse-Weil theorem and Goppa codes, I will be able to learn about those parts I did not fully understand such as the proof of the Riemann hypothesis for curves and the modular curves $X_0(N)$, which give a counterexample to the hypothesis that the Gilbert-Varshamov bound is best possible.

Reviewer to reader. Mathematicians, as other scientists, hunt in separate groups mostly making minimal contact with other groups at a research level; so there is a real frisson of excitement when a new development brings disparate groups together.

In 1981 Goppa derived a class of linear codes from algebraic curves over finite fields, which (1) are quite general as codes, (2) have parameters circumscribed by the Riemann-Roch theorem, and (3) have asymptotic properties which improve the classical Gilbert-Varshamov bound. The discovery of these codes also gave renewed stimulus to investigations on the number of points on an algebraic curve for a particular genus as well as to asymptotic values of the ratio of the number of points to the genus. The Goppa codes therefore link algebraic geometry, number theory, and coding theory.

The interest in this topic is demonstrated by the number of survey articles [1, 6, 10, 14–18] and books [11, 13] that have appeared.

Reviewer to author. I like the first sentence of the preface: "This is an introduction to the theory of algebraic curves over finite fields." The last sentence I find somewhat mystifying: "Chapter 5 on error correcting codes and the appendix may be studied independently from the rest of the book; they are intended mostly for workers in the field who want to understand the new results about codes on algebraic curves over finite fields." Does this mean that coding theorists