the reduced C*-algebra is an isomorphism. V. F. R. Jones in a paper 'Subfactors and related topics' surveys some of the known relationships between commuting squares of subfactors of a factor, vertex models, the Yang–Baxter equation, knot theory, quantum groups and field theory. With such broad cover this paper is a brief account of the current situation. This is followed by a long technical paper 'Quantized groups, string algebras, and Galois theory for algebras' by A. Ocneanu in which he introduces a Galois type invariant for the position of a subalgebra inside an algebra. S. Popa discusses amenability of type II_1 factors. B. Blackadar surveys various problems concerning comparison theories for simple C*-algebras using the existing Murray-von Neumann comparison theory for projections in a von Neumann algebra as a guide. There are papers on operator algebras from the borders of mathematical physics to those of geometry, Lie groups and topology. These volumes are recommended to those who work in operator algebras and their closely related areas.

ALLAN M. SINCLAIR

KIRWAN, F. *An introduction to intersection homology theory* (Pitman Research Notes in Mathematics Series 187, Longman Scientific and Technical, 1988) 169 pp. 0 582 02879 5, £15.

A manifold is a topological space which is locally homeomorphic to a Euclidean space of a fixed dimension. The homology and cohomology of a manifold are related by the Poincaré duality isomorphisms. A singular space is a topological space which is a manifold except for some singularities. The Zeeman dihomology sequence related the singularities to the failure of Poincaré duality in a singular space. Sullivan and McCrory advocated this spectral sequence as a tool for the study of the topology of singular spaces. This bore fruit in the remarkable intersection homology theory developed over the last ten years by Goresky and MacPherson. The intersection homology groups of a singular space are defined using the singularities. In particular, singular spaces have Poincaré duality with respect to intersection homology. A singular space without singularities is a manifold, in which case the intersection homology groups coincide with the classically defined homology groups.

This book is the written record of what must have been an enjoyable graduate course introducing intersection homology to a non-specialist audience. It gives a clear account of the basic theory and the major applications. Chapter 1 gives the three main examples: the cohomology of complex projective varieties, de Rham and L^2-cohomology, and Morse theory for singular spaces. In each case intersection homology reaches parts other homology theories cannot reach. Chapter 2 is a useful review of the relevant homological algebra, including sheaf cohomology. Chapter 3 contains the first definition of the intersection homology groups, using chain complexes. Chapter 4 deals with L^2-cohomology, the analytic counterpart of the theory. Chapter 5 gives the sheaf-theoretic construction. Finally, Chapters 6, 7 and 8 deal with the applications of intersection homology to respectively the Weil conjectures relating algebraic number theory and algebraic geometry, the D-module theory relating differential equations and algebraic geometry, and the Kazhdan-Lustig conjecture in the representation theory of Lie algebras.

The level of exposition is more accessible than the articles in A. Borel et al., *Intersection cohomology* (Progress in Mathematics 50, Birkhäuser, Basel 1984), which are aimed at a specialist audience.

One can only wish that more graduate courses would lead to such stimulating and valuable lecture notes.

A. RANICKI

REID, M. *Undergraduate algebraic geometry* (London Mathematical Society Student Texts 12, Cambridge University Press, Cambridge 1988), viii + 129 pp, hard covers: 0 521 35559 1, £20; paper: 0 521 35662 8, £7.50.

A desire for honesty, via rigour, in our undergraduate courses is often attained at the cost of implementing (dishonest) axiomatic methods. Traditional undergraduate topics concerning, for

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example, algebraic curves or the differential geometry of surfaces obstinately refuse convenient and neat axiomatic packaging and have, over the years, been forced out of many undergraduate courses. One suspects that few if any courses on algebraic geometry are taught nowadays using the texts of Coolidge or Semple and his collaborators, and even the relatively rigorous book of Walker has a rather dated viewpoint. Recent texts are all suitable for postgraduates only, so there is a need for a genuine Undergraduate Algebraic Geometry.

Miles Reid's offering is based on notes from a course given to 3rd year Warwick undergraduates. As the author points out (in an early section labelled 'woffle') the traditional problem with designing an undergraduate algebraic geometry course is that erecting an adequate framework leaves no time for adding geometric flesh to the bare algebraic bones. On the other hand an explicit bare hands approach rapidly runs into problems which mere ingenuity cannot simplify. Reid's compromise is to cover a small(ish) part of the theory with constant reference to specific examples, and it is a compromise which works well. The first chapter (and third) of the book introduces some of the examples: largely conics and cubics in the projective plane. Weak forms of Bezout's theorem are established which suffice to prove some interesting geometric facts – in particular furnishing nonsingular cubics with a group structure. The second chapter introduces the category of affine varieties. The unavoidable discontinuity from specific geometric construction to the generalities of commutative algebra is handled well. There are discussions of the Hilbert Basis Theorem, the correspondence between ideals and algebraic sets, the Nullstellensatz, the concepts of morphism, isomorphism, rational maps etc., with references to specific examples where possible.

The final chapter is devoted to applications of this central block of algebra. There is material on projective and birational geometry (partly the projectivization of the earlier affine algebra), the notions of tangent space and dimension. Finally there is a section on the classical topic of the 27 lines lying on a cubic surface. Unfortunately there is a mistake in the author's proof that every nonsingular cubic contains at least one line, which is not trivially repairable. If one assumes this result, so restricts attention only to cubic surfaces containing lines, the remaining discussion is complete and very nice.

The book concludes with a brief 'History and sociology of the modern subject' and 'Additional footnotes and highbrow comments', the latter largely for those of *us* intending to use the book to give a course (to *them*). I found these sections informative, possibly contentious, but very entertaining. Indeed this is a very good text book, written with style and humour (as one would expect from the author). It is, I believe, a genuine undergraduate text, and as such has no real competitor. Of course one has the usual reservations – one easily summons to mind undergraduates for whom this material (or that contained in any undergraduate text!) would prove baffling. The material is demanding, but the text together with its vital exercises provides the basis of a very respectable third year option.

J. W. BRUCE

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