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DAPHNE ZAYDEN

Elements of the Representation Theory of Associative Algebras: Volume 1 CRC Press
This three-volume work contains articles collected on the occasion of Alexander Grothendieck's sixtieth birthday and originally published in 1990. The articles were offered as a tribute to one of the world's greatest living mathematicians. Many of the groundbreaking contributions in these volumes contain material that is now considered foundational to the subject. Topics addressed by these top-notch contributors match the breadth of Grothendieck's own interests, including: functional analysis, algebraic geometry, algebraic topology, number theory, representation theory, K-theory, category theory, and homological algebra.

An Introduction to Quiver Representations
Springer Science & Business Media
This first part of a two-volume set offers a modern account of the representation theory of finite dimensional associative algebras over an algebraically closed field. The authors present this topic from the perspective of linear representations of finite-oriented graphs (quivers) and homological algebra. The self-contained treatment constitutes an elementary, up-to-date introduction to the subject

using, on the one hand, quiver-theoretical techniques and, on the other, tilting theory and integral quadratic forms. Key features include many illustrative examples, plus a large number of end-of-chapter exercises. The detailed proofs make this work suitable both for courses and seminars, and for self-study. The volume will be of great interest to graduate students beginning research in the representation theory of algebras and to mathematicians from other fields.

Noncommutative Algebra Birkhäuser Over the last three decades representation theory of groups, Lie algebras and associative algebras has undergone a rapid development through the powerful tool of almost split sequences and the Auslander-Reiten quiver. Further insight into the homology of finite groups has illuminated their representation theory. The study of Hopf algebras and non-commutative geometry is another new branch of representation theory which pushes the classical theory further. All this can only be seen in connection with an understanding of the structure of special classes of rings. The aim of this book is to introduce the reader to some modern developments in: Lie algebras, quantum groups, Hopf algebras and algebraic groups; non-commutative algebraic geometry; representation theory of finite groups and cohomology; the structure of special

classes of rings.
Representation Theory Springer
For any researcher working in representation theory, algebraic or arithmetic geometry.
Toruń-Trondheim Representation Theory School Cambridge University Press
This book is the first volume of an intensive "Russian-style" two-year graduate course in abstract algebra, and introduces readers to the basic algebraic structures – fields, rings, modules, algebras, groups, and categories – and explains the main principles of and methods for working with them. The course covers substantial areas of advanced combinatorics, geometry, linear and multilinear algebra, representation theory, category theory, commutative algebra, Galois theory, and algebraic geometry – topics that are often overlooked in standard undergraduate courses. This textbook is based on courses the author has conducted at the Independent University of Moscow and at the Faculty of Mathematics in the Higher School of Economics. The main content is complemented by a wealth of exercises for class discussion, some of which include comments and hints, as well as problems for independent study.
Characters of Groups and Lattices over Orders Princeton University Press
Introducing the representation theory of groups and finite dimensional algebras, first studying basic non-commutative ring theory,

this book covers the necessary background on elementary homological algebra and representations of groups up to block theory. It further discusses vertices, defect groups, Green and Brauer correspondences and Clifford theory. Whenever possible the statements are presented in a general setting for more general algebras, such as symmetric finite dimensional algebras over a field. Then, abelian and derived categories are introduced in detail and are used to explain stable module categories, as well as derived categories and their main invariants and links between them. Group theoretical applications of these theories are given – such as the structure of blocks of cyclic defect groups – whenever appropriate. Overall, many methods from the representation theory of algebras are introduced. Representation Theory assumes only the most basic knowledge of linear algebra, groups, rings and fields and guides the reader in the use of categorical equivalences in the representation theory of groups and algebras. As the book is based on lectures, it will be accessible to any graduate student in algebra and can be used for self-study as well as for classroom use.

The Grothendieck Festschrift, Volume III
Springer Science & Business Media
Homological algebra has found a large number of applications in many fields ranging from finite and infinite group theory to representation theory,

number theory, algebraic topology and sheaf theory. In the new edition of this broad introduction to the field, the authors address a number of select topics and describe their applications, illustrating the range and depth of their developments. A comprehensive set of exercises is included.

An Introduction to Homological Algebra
Cambridge University Press
A self-contained introduction is given to J. Rickard's Morita theory for derived module categories and its recent applications in representation theory of finite groups. In particular, Broué's conjecture is discussed, giving a structural explanation for relations between the p-modular character table of a finite group and that of its "p-local structure". The book is addressed to researchers or graduate students and can serve as material for a seminar. It surveys the current state of the field, and it also provides a "user's guide" to derived equivalences and tilting complexes. Results and proofs are presented in the generality needed for group theoretic applications.
(Mostly) Commutative Algebra Birkhäuser
The landscape of homological algebra has evolved over the last half-century into a fundamental tool for the working mathematician. This book provides a unified account of homological algebra as it exists today. The historical connection with topology, regular local

rings, and semi-simple Lie algebras are also described. This book is suitable for second or third year graduate students. The first half of the book takes as its subject the canonical topics in homological algebra: derived functors, Tor and Ext, projective dimensions and spectral sequences. Homology of group and Lie algebras illustrate these topics. Intermingled are less canonical topics, such as the derived inverse limit functor lim1, local cohomology, Galois cohomology, and affine Lie algebras. The last part of the book covers less traditional topics that are a vital part of the modern homological toolkit: simplicial methods, Hochschild and cyclic homology, derived categories and total derived functors. By making these tools more accessible, the book helps to break down the technological barrier between experts and casual users of homological algebra.
Interactions between Representation Theory, Algebraic Topology and Commutative Algebra Cambridge University Press
This volume presents an elaborated version of lecture notes for two advanced courses: (Re)Emerging methods in Commutative Algebra and Representation Theory and Building Bridges Between Algebra and Topology, held at the CRM in the spring of 2015. Homological algebra is a rich and ubiquitous area; it is both an active field of research and a widespread toolbox for

many mathematicians. Together, these notes introduce recent applications and interactions of homological methods in commutative algebra, representation theory and topology, narrowing the gap between specialists from different areas wishing to acquaint themselves with a rapidly growing field. The covered topics range from a fresh introduction to the growing area of support theory for triangulated categories to the striking consequences of the formulation in the homotopy theory of classical concepts in commutative algebra. Moreover, they also include a higher categories view of Hall algebras and an introduction to the use of idempotent functors in algebra and topology.

Algebra - Representation Theory

Springer Nature

This text presents six mini-courses, all devoted to interactions between representation theory of algebras, homological algebra, and the new ever-expanding theory of cluster algebras. The interplay between the topics discussed in this text will continue to grow and this collection of courses stands as a partial testimony to this new development. The courses are useful for any mathematician who would like to learn more about this rapidly developing field; the primary aim is to engage graduate students and young researchers. Prerequisites include knowledge of some noncommutative algebra or homological algebra.

Homological algebra has always been considered as one of the main tools in the study of finite-dimensional algebras. The strong relationship with cluster algebras is more recent and has quickly established itself as one of the important highlights of today’s mathematical landscape. This connection has been fruitful to both areas—representation theory provides a categorification of cluster algebras, while the study of cluster algebras provides representation theory with new objects of study. The six mini-courses comprising this text were delivered March 7–18, 2016 at a CIMPA (Centre International de Mathématiques Pures et Appliquées) research school held at the Universidad Nacional de Mar del Plata, Argentina. This research school was dedicated to the founder of the Argentinian research group in representation theory, M.I. Platzeck. The courses held were: Advanced homological algebra Introduction to the representation theory of algebras Auslander-Reiten theory for algebras of infinite representation type Cluster algebras arising from surfaces Cluster tilted algebras Cluster characters Introduction to K-theory Brauer graph algebras and applications to cluster algebras

From Ordinary to Integral Representation Theory

Cambridge University Press

Introducing the representation theory of groups and finite dimensional algebras, first

studying basic non-commutative ring theory, this book covers the necessary background on elementary homological algebra and representations of groups up to block theory. It further discusses vertices, defect groups, Green and Brauer correspondences and Clifford theory. Whenever possible the statements are presented in a general setting for more general algebras, such as symmetric finite dimensional algebras over a field. Then, abelian and derived categories are introduced in detail and are used to explain stable module categories, as well as derived categories and their main invariants and links between them. Group theoretical applications of these theories are given - such as the structure of blocks of cyclic defect groups - whenever appropriate. Overall, many methods from the representation theory of algebras are introduced.
Representation Theory assumes only the most basic knowledge of linear algebra, groups, rings and fields and guides the reader in the use of categorical equivalences in the representation theory of groups and algebras. As the book is based on lectures, it will be accessible to any graduate student in algebra and can be used for self-study as well as for classroom use.
A Course in Homological Algebra Walter de Gruyter GmbH & Co KG
This English edition has an additional chapter "Elements of Homological Al gebra". Homological methods appear to be

effective in many problems in the theory of algebras; we hope their inclusion makes this book more complete and self-contained as a textbook. We have also taken this occasion to correct several inaccuracies and errors in the original Russian edition. We should like to express our gratitude to V. Dlab who has not only metic ulously translated the text, but has also contributed by writing an Appendix devoted to a new important class of algebras, viz. quasi-hereditary algebras. Finally, we are indebted to the publishers, Springer-Verlag, for enabling this book to reach such a wide audience in the world of mathematical community. Kiev, February 1993 Yu.A. Drozd V.V. Kirichenko Preface The theory of finite dimensional algebras is one of the oldest branches of modern algebra. Its origin is linked to the work of Hamilton who discovered the famous algebra of quaternions, and Cayley who developed matrix theory. Later finite dimensional algebras were studied by a large number of mathematicians including B. Peirce, C.S. Peirce, Clifford, ·Weierstrass, Dedekind, Jordan and Frobenius. At the end of the last century T. Molien and E. Cartan described the semisimple algebras over the complex and real fields and paved the first steps towards the study of non-semi simple algebras. *Representations and Cohomology: Volume 2, Cohomology of Groups and Modules* American Mathematical Soc.

This book is concerned with recent trends in the representation theory of algebras and its exciting interaction with geometry, topology, commutative algebra, Lie algebras, quantum groups, homological algebra, invariant theory, combinatorics, model theory and theoretical physics. The collection of articles, written by leading researchers in the field, is conceived as a sort of handbook providing easy access to the present state of knowledge and stimulating further development. The topics under discussion include diagram algebras, Brauer algebras, cellular algebras, quasi-hereditary algebras, Hall algebras, Hecke algebras, symplectic reflection algebras, Cherednik algebras, Kashiwara crystals, Fock spaces, preprojective algebras, cluster algebras, rank varieties, varieties of algebras and modules, moduli of representations of quivers, semi-invariants of quivers, Cohen-Macaulay modules, singularities, coherent sheaves, derived categories, spectral representation theory, Coxeter polynomials, Auslander-Reiten theory, Calabi-Yau triangulated categories, Poincare duality spaces, selfinjective algebras, periodic algebras, stable module categories, Hochschild cohomologies, deformations of algebras, Galois coverings of algebras, tilting theory, algebras of small homological dimensions, representation types of algebras, and model theory. This book consists of fifteen self-contained expository survey articles and is addressed to researchers and graduate students in algebra as well as a broader mathematical community. They contain a large number of open problems and give new perspectives for research in the field.

Building Bridges Between Algebra and Topology

American Mathematical Soc.

When this book was written, methods of algebraic topology had caused revolutions in the world of pure algebra. To clarify the advances that had been made, Cartan and Eilenberg tried to unify the fields and to construct the framework of a fully fledged theory. The invasion of algebra had occurred on three fronts through the construction of cohomology theories for groups, Lie algebras, and associative algebras. This book presents a single homology (and also cohomology) theory that embodies all three; a large number of results is thus established in a general framework. Subsequently, each of the three theories is singled out by a suitable specialization, and its specific properties are studied. The starting point is the notion of a module over a ring. The primary operations are the tensor product of two modules and the groups of all homomorphisms of one module into another. From these, "higher order" derived of operations are obtained, which enjoy all the properties usually attributed to homology theories. This leads in a natural way to the study of "functors" and of their "derived functors." This mathematical masterpiece will appeal to all mathematicians working in algebraic topology.

An Elementary Approach to Homological Algebra
American Mathematical Soc.
This is the first of two volumes providing an introduction to modern developments in the representation theory of finite groups and associative algebras, which have transformed the subject into a study of categories of modules. Thus, Dr. Benson's unique perspective in this book incorporates homological algebra and the theory of representations of finite-dimensional algebras. This volume is primarily concerned with the exposition of the necessary background material, and the heart of the discussion is a lengthy introduction to the (Auslander-Reiten) representation theory of finite dimensional algebras, in which the techniques of quivers with relations and almost-split sequences are discussed in some detail.
Springer
About This Book This book is meant to be used by beginning graduate students. It covers basic material needed by any student of algebra, and is essential to those specializing in ring theory, homological algebra, representation theory and K-theory, among others. It will also be of interest to students of algebraic topology, functional

analysis, differential geometry and number theory. Our approach is more homological than ring-theoretic, as this leads the to many important areas of mathematics. This ap student more quickly proach is also, we believe, cleaner and easier to understand. However, the more classical, ring-theoretic approach, as well as modern extensions, are also presented via several exercises and sections in Chapter Five. We have tried not to leave any gaps on the paths to proving the main theorem- at most we ask the reader to fill in details for some of the sideline results; indeed this can be a fruitful way of solidifying one's understanding. *Derived Equivalences for Group Rings* European Mathematical Society Calogero-Moser systems, which were originally discovered by specialists in integrable systems, are currently at the crossroads of many areas of mathematics and within the scope of interests of many mathematicians. More specifically, these systems and their generalizations turned out to have intrinsic connections with such fields as algebraic geometry (Hilbert schemes of surfaces), representation theory (double affine Hecke algebras, Lie groups, quantum groups), deformation theory (symplectic reflection algebras), homological algebra (Koszul algebras), Poisson geometry, etc. The goal of the present lecture notes is to give an

introduction to the theory of Calogero-Moser systems, highlighting their interplay with these fields. Since these lectures are designed for non-experts, the author gives short introductions to each of the subjects involved and provides a number of exercises.
Finite Dimensional Algebras American Mathematical Soc.
Gorenstein homological algebra is an important area of mathematics, with applications in commutative and noncommutative algebra, model category theory, representation theory, and algebraic geometry. While in classical homological algebra the existence of the projective, injective, and flat resolutions over arbitrary rings are well known, things are a little different when it comes to Gorenstein homological algebra. The main open problems in this area deal with the existence of the Gorenstein injective, Gorenstein projective, and Gorenstein flat resolutions. Gorenstein Homological Algebra is especially suitable for graduate students interested in homological algebra and its applications.
Homological Algebra Cambridge University Press
This book is an introduction to the representation theory of quivers and finite dimensional algebras. It gives a thorough and modern treatment of the algebraic approach based on Auslander-Reiten theory as well as the approach based on geometric invariant

theory. The material in the opening chapters is developed starting slowly with topics such as homological algebra, Morita equivalence, and Gabriel's theorem. Next, the book presents Auslander-Reiten theory, including almost split sequences and the Auslander-Reiten transform, and gives a proof of Kac's generalization of Gabriel's theorem. Once this basic material is established, the book goes on with developing the geometric invariant theory of quiver representations. The book features the exposition of the saturation theorem for semi-invariants of quiver representations and its application to Littlewood-Richardson coefficients. In the final chapters, the book exposes tilting modules, exceptional sequences and a connection to cluster categories. The book is suitable for a graduate course in quiver representations and has numerous exercises and examples throughout the text. The book will also be of use to experts in such areas as representation theory, invariant theory and algebraic geometry, who want to learn about applications of quiver representations to their fields.