

Contents

Preface	ix
Part 1. Algebraic groups and their generalizations: Classical methods	
§1. A previously unpublished paper of C. Chevalley	
Sur les décompositions cellulaires des espaces G/B C. CHEVALLEY	1
§2. Perverse sheaves, Kazhdan Lusztig program, and related topics	
Introduction to middle intersection cohomology and perverse sheaves ARMAND BOREL	25
The Bruhat graph of a Coxeter group, a conjecture of Deodhar, and rational smoothness of Schubert varieties JAMES B. CARRELL	53
Simulating perverse sheaves in modular representation theory EDWARD CLINE, BRIAN PARSHALL, AND LEONARD SCOTT	63
A brief survey of Kazhdan-Lusztig theory and related topics VINAY DEODHAR	105
§3. Finite Chevalley groups and related matters	
Green theory for Hecke algebras and Harish-Chandra philosophy RICHARD DIPPER	125
Liftable deformations and Hecke algebras M. SCHAPS	155
A Hecke algebra of the symmetric group ELI A. SIEGEL	175
Character sheaves: Applications to finite groups BHAMA SRINIVASAN	183

§4. Algebraic groups, general theory

Real algebraic quotients RALPH J. BREMIGAN	195
Frobenius splitting of spherical varieties M. BRION AND S. P. INAMDAR	207
Generalized Kloosterman sums ROMUALD DĄBROWSKI	219
Symmetric k -varieties A. G. HELMINCK	233
Identities for prounipotent groups ANDY R. MAGID	281
On the structure of nonreduced parabolic subgroup-schemes CHRISTIAN WENZEL	291

§5. Representations

Weight modules without highest weight A. J. COLEMAN	299
Extremal composition factors for groups of Lie type J. E. HUMPHREYS	303
Relative invariants of the polynomial rings over the finite and tame type quivers KOIKE KAZUHIKO	311

§6. Invariant theory

Hilbert series for modules of covariants BRAM BROER	321
The first fundamental theorem of invariant theory and spherical subgroups ROGER E. HOWE	333
Algebraic families of $O(2)$ -actions on affine space \mathbb{C}^4 MIKIYA MASUDA AND TED PETRIE	347
Algebraic equivariant vector bundles and the linearity problem LUCY MOSER-JAUSSLIN	355
Equivariant matrix valued functions GEORGE F. SEELINGER	365

Constructive invariant theory

DAVID L. WEHLAU

377

Part 2. Algebraic groups and their generalizations: Quantum and infinite-dimensional methods**§1. The general theory of quantum groups**

Finite dimensional representations of quantum groups

HENNING HAAHR ANDERSEN

1

An introduction to quantum groups

PIERRE CARTIER

19

Examples of compact matrix pseudogroups arising from Drinfel'd's twisting operation

BENJAMIN ENRIQUEZ

43

Face algebras and their Drinfeld doubles

TAKAHIRO HAYASHI

49

Representation theory for quantized enveloping algebras

GAIL LETZTER

63

Rational representations of Hopf algebras

ZONGZHU LIN

81

Filtrations of modules over the quantum algebra

JAN PARADOWSKI

93

Quantum groups as invariance groups

A. SUDBERY

109

The quantum hyperalgebra of $SL_q(2)$

MITSUHIRO TAKEUCHI

121

§2. Crystal bases

IC bases and quantum linear groups

JIE DU

135

Bases for quantum Demazure modules. II

V. LAKSHMIBAI

149

Problems on canonical bases

G. LUSZTIG

169

§3. Quantum groups and category theory

2-categories and Zamolodchikov tetrahedra equations

M. M. KAPRANOV AND V. A. VOEVODSKY

177

§4. Vertex operator algebras, the moonshine module and related topicsAbelian intertwining algebras—A generalization of vertex operator
algebras

CHONGYING DONG AND JAMES LEPOWSKY

261

Discrete series of the Virasoro algebra and the moonshine module

CHONGYING DONG, GEOFFREY MASON, AND YONGCHANG
ZHU

295

Constructions of vertex operator algebras

ALEX J. FEINGOLD

317

Binary trees and finite-dimensional Lie algebras

YI-ZHI HUANG

337

§5. Infinite dimensional groups and Lie algebras

Holomorphic line bundles over Hilbert flag varieties

A. G. HELMINCK AND G. F. HELMINCK

349

New classes of infinite-dimensional Lie groups

LOKI NATARAJAN, ENRIQUETA RODRÍGUEZ-CARRINGTON,
AND JOSEPH A. WOLF

377

On forms of Kac-Moody algebras

GUY ROUSSEAU

393

Semi-infinite cohomology of Lie algebras

ALEXANDER A. VORONOV

401