

# Contents

<b>Preface</b>	ix
<b>Part 1. Algebraic groups and their generalizations: Classical methods</b>	
<b>§1. A previously unpublished paper of C. Chevalley</b>	
Sur les décompositions cellulaires des espaces $G/B$	
C. CHEVALLEY	1
<b>§2. Perverse sheaves, Kazhdan Lusztig program, and related topics</b>	
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
<b>§3. Finite Chevalley groups and related matters</b>	
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 $C^4$ MIKIYA MASUDA AND TED PETRIE	347
Algebraic equivariant vector bundles and the linearity problem LUCY MOSER-JAUSLIN	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 topics**

- Abelian intertwining algebras—A generalization of vertex operator algebras  
CHONGYING DONG AND JAMES LPOWSKY 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