

Contents

Preface		<i>page vii</i>
Prologue:		
General Remarks on Computer Algebra Systems		1
1 The Geometry–Algebra Dictionary		11
1.1 Affine Algebraic Geometry		11
1.1.1 Ideals in Polynomial Rings		11
1.1.2 Affine Algebraic Sets		14
1.1.3 Hilbert’s Nullstellensatz		20
1.1.4 Irreducible Algebraic Sets		23
1.1.5 Removing Algebraic Sets		25
1.1.6 Polynomial Maps		29
1.1.7 The Geometry of Elimination		32
1.1.8 Noether Normalization and Dimension		37
1.1.9 Local Studies		45
1.2 Projective Algebraic Geometry		49
1.2.1 The Projective Space		49
1.2.2 Projective Algebraic Sets		52
1.2.3 Affine Charts and the Projective Closure		54
1.2.4 The Hilbert Polynomial		57
2 Computing		60
2.1 Standard Bases and SINGULAR		60
2.2 Applications		75
2.2.1 Ideal Membership		75
2.2.2 Elimination		75
2.2.3 Radical Membership		77
2.2.4 Ideal Intersections		78

Cambridge University Press

978-1-107-61253-2 - A First Course in Computational Algebraic Geometry

Wolfram Decker and Gerhard Pfister

Table of Contents

[More information](#)

vi

Contents

2.2.5	Ideal Quotients	79
2.2.6	Kernel of a Ring Map	79
2.2.7	Integrality Criterion	80
2.2.8	Noether Normalization	82
2.2.9	Subalgebra Membership	83
2.2.10	Homogenization	83
2.3	Dimension and the Hilbert Function	84
2.4	Primary Decomposition and Radicals	90
2.5	Buchberger's Algorithm and Field Extensions	94
3	Sudoku	95
4	A Problem in Group Theory Solved by Computer Algebra	101
4.1	Finite Groups and Thompson's Theorem	101
4.2	Characterization of Finite Solvable Groups	104
	Bibliography	112
	Index	115