

Table of Contents

I.	Introduction	1
	Lie algebras graded by finite reduced root systems	1
	BC_r -graded Lie algebras	3
	Examples of BC_r -graded Lie algebras	4
	Outline of methods and summary of results	9
II.	The \mathfrak{g} -module decomposition of a BC_r -graded Lie algebra, $r \geq 3$ (excluding type D_3)	18
	General analysis	18
	Multiplication in a BC_r -graded Lie algebra, $r \geq 3$	22
	Properties of the algebras \mathfrak{a} and \mathfrak{b}	24
	Lie algebras graded by C_r , $r \geq 3$	27
	Properties of the space C	29
	Bilinear maps on C	30
	The structure theorem for BC_r -graded Lie algebras, $r \geq 3$ (not of type D_3)	32
	The coordinate algebra \mathfrak{b}	33
III.	Models for BC_r -graded Lie algebras, $r \geq 3$ (excluding type D_3)	36
	Inner derivations	37
	Classification of BC_r -graded Lie algebras, $r \geq 3$, not of type D_3	38
	The model when \mathfrak{a} is associative	39
	J -ternary algebras	42
	The model when $r = 3$ and \mathfrak{g} has type C_3	45
IV.	The \mathfrak{g} -module decomposition of a BC_r -graded Lie algebra with grading subalgebra of type B_2 , C_2 , D_2 or D_3	52
	The homomorphisms ϖ and τ	53
	The homomorphism ϑ	54
	The decomposition in the B_2 , C_2 , and D_3 cases	55
	The coordinate algebra in the B_2 , C_2 , and D_3 cases	56
	Calculation of the inner derivations in the B_2 , C_2 , and D_3 cases	58
	BC_r -coordinate algebras in the B_2 , C_2 , and D_3 cases	67
	The decomposition in the D_2 case	68
	The coordinate algebra in the D_2 case	70
	Calculation of the inner derivations in the D_2 case	72
	BC_2 -coordinate algebras in the D_2 case	76
	BC_r -coordinate algebras in general	76

V.	Central extensions, derivations and invariant forms	77
	Skew-dihedral homology	79
	The universal central extension of a BC_r -graded algebra, $r \geq 2$	83
	Derivations of BC_r -graded Lie algebras, $r \geq 2$	87
	Invariant forms of BC_r -graded Lie algebras, $r \geq 2$	90
	Appendix of proofs for types B_2 , C_2 , D_2 and D_3	94
VI.	Models of BC_r -graded Lie algebras with	
	grading subalgebra of type B_2 , C_2 , D_2 or D_3	100
	Structurable algebras and the Kantor construction	101
	Peirce decompositions in structurable algebras	103
	Models of BC_r -graded Lie algebras with grading subalgebra of type B_2 , D_2 or D_3	106
	The coordinate algebra in the B_2 case	112
	Examples in the B_2 case	116
	The coordinate algebra in the D_2 case	118
	Examples in the D_2 case	123
	The coordinate algebra in the D_3 case	124
	Examples in the D_3 case	127
	J -ternary algebras and the Lie algebra construction $L(J, X)$	128
	Peirce decompositions in J -ternary algebras	128
	Models of BC_2 -graded Lie algebras with grading subalgebra of type C_2	130
	The coordinate algebra in the C_2 case	132
	Examples in the C_2 case	135
VII.	Appendix: Peirce decompositions in structurable algebras	138
	Identities in structurable algebras	138
	Peirce decompositions	139
	The connection automorphism	145
	Hermitian quadrangles	151
	References	156