
Contents

Part I CASL Summary

Editors: Bernd Krieg-Brückner (University of Bremen, Germany) and

Peter D. Mosses (University of Aarhus, Denmark)

Authors: The CoFI Language Design Group

1	Introduction	3
2	Basic Specifications	5
2.1	Basic Concepts	5
2.1.1	Signatures	6
2.1.2	Models	7
2.1.3	Sentences	7
2.1.4	Satisfaction	8
2.2	Basic Items	9
2.3	Signature Declarations	10
2.3.1	Sorts	10
2.3.2	Operations	11
2.3.3	Predicates	13
2.3.4	Datatypes	14
2.3.5	Sort Generation	17
2.4	Variables	17
2.4.1	Global Variable Declarations	17
2.4.2	Local Variable Declarations	18
2.5	Axioms	18
2.5.1	Quantifications	19
2.5.2	Logical Connectives	19
2.5.3	Atomic Formulas	21
2.5.4	Terms	23
2.6	Identifiers	25

3	Subsorting Specifications	27
3.1	Subsorting Concepts	27
3.1.1	Signatures	27
3.1.2	Models	28
3.1.3	Sentences	28
3.2	Signature Declarations	29
3.2.1	Sorts	29
3.2.2	Datatypes	30
3.3	Axioms	31
3.3.1	Atomic Formulas	31
3.3.2	Terms	32
4	Structuring Specifications	33
4.1	Structuring Concepts	33
4.1.1	Structured Specifications	33
4.1.2	Named and Generic Specifications	34
4.1.3	Signature and Specification Morphisms	35
4.2	Structured Specifications	36
4.2.1	Translations	37
4.2.2	Reductions	37
4.2.3	Unions	38
4.2.4	Extensions	39
4.2.5	Free Specifications	39
4.2.6	Local Specifications	40
4.2.7	Closed Specifications	40
4.3	Named and Generic Specifications	40
4.3.1	Specification Definitions	40
4.3.2	Specification Instantiation	42
4.4	Views	43
4.4.1	View Definitions	43
4.4.2	Fitting Views	44
4.5	Symbol Lists and Mappings	45
4.5.1	Symbol Lists	45
4.5.2	Symbol Mappings	46
4.6	Compound Identifiers	47
5	Architectural Specifications	49
5.1	Architectural Concepts	49
5.1.1	Unit Functions	49
5.1.2	Persistency and Compatibility	50
5.2	Architectural Specification Definitions	50
5.3	Unit Declarations and Definitions	51
5.3.1	Unit Declarations	52
5.3.2	Unit Definitions	52

5.4	Unit Specifications	52
5.4.1	Unit Types	53
5.4.2	Architectural Unit Specifications	53
5.4.3	Closed Unit Specifications	53
5.5	Unit Expressions	54
5.5.1	Unit Terms	54
6	Specification Libraries	57
6.1	Library Concepts	57
6.2	Local Libraries	58
6.3	Distributed Libraries	58
6.4	Library Names	59
7	Sublanguages and Extensions	61
7.1	Sublanguages	61
7.1.1	A Language for Naming Sublanguages	61
7.1.2	A List of Orthogonal Features	64
7.1.3	A List of Levels of Expressiveness	65
7.2	Extensions	68
7.2.1	Higher-Order and Coalgebraic Extensions	68
7.2.2	Reactive Extensions	68
7.2.3	Extensions at the Structured Level	69

Part II CASL Syntax

*Editors: Bernd Krieg-Brückner (University of Bremen, Germany) and
Peter D. Mosses (University of Aarhus, Denmark)*

Authors: The CoFI Language Design Group

1	Introduction	73
2	Abstract Syntax	75
2.1	Normal Grammar	76
2.1.1	Basic Specifications	76
2.1.2	Subsorting Specifications	78
2.1.3	Structured Specifications	78
2.1.4	Architectural Specifications	79
2.1.5	Specification Libraries	80
2.2	Abbreviated Grammar	81
2.2.1	Basic Specifications	81
2.2.2	Subsorting Specifications	83
2.2.3	Structured Specifications	83
2.2.4	Architectural Specifications	84
2.2.5	Specification Libraries	85

3	Concrete Syntax	87
3.1	Context-Free Grammar	88
3.1.1	Basic Specifications	88
3.1.2	Subsorting Specifications	90
3.1.3	Structured Specifications	91
3.1.4	Architectural Specifications	92
3.1.5	Specification Libraries	93
3.2	Disambiguation	93
3.2.1	Precedence	94
3.2.2	Mixfix Grouping Analysis	95
3.2.3	Mixfix Identifiers	96
4	Lexical Symbols	97
4.1	Key Words and Signs	97
4.1.1	Key Words	98
4.1.2	Key Signs	98
4.1.3	Display Format	98
4.2	Tokens	99
4.2.1	Words	99
4.2.2	Signs	99
4.2.3	Quoted Characters	100
4.3	Literal Strings and Numbers	100
4.4	URLs and Paths	101
5	Comments and Annotations	103
5.1	Comments	104
5.2	Annotations	105
5.2.1	Label Annotations	106
5.2.2	Display Annotations	106
5.2.3	Parsing Annotations	106
5.2.4	Literal Annotations	108
5.2.5	Semantic Annotations	110
5.2.6	Miscellaneous Annotations	111

Part III CASL Semantics

Editors: Donald Sannella (University of Edinburgh, United Kingdom) and Andrzej Tarlecki (Warsaw University, Poland)

Authors: Hubert Baumeister (LMU Munich, Germany),

Maura Cerioli (University of Genova, Italy),

Anne Haxthausen (Technical University of Denmark),

Till Mossakowski (University of Bremen, Germany),

Peter D. Mosses (University of Aarhus, Denmark),

Donald Sannella (University of Edinburgh, United Kingdom), and

Andrzej Tarlecki (Warsaw University, Poland)

1	Introduction	115
1.1	Notation	116
1.2	Static Semantics and Model Semantics	118
1.3	Semantic Rules	119
1.4	Institution Independence	120
2	Basic Specification Semantics	123
2.1	Basic Concepts	123
2.1.1	Signatures	124
2.1.2	Models	128
2.1.3	Sentences	131
2.1.4	Satisfaction	135
2.2	Basic Items	138
2.3	Signature Declarations	140
2.3.1	Sorts	140
2.3.2	Operations	141
2.3.3	Predicates	145
2.3.4	Datatypes	147
2.3.5	Sort Generation	157
2.4	Variables	157
2.4.1	Global Variable Declarations	158
2.4.2	Local Variable Declarations	158
2.5	Axioms	159
2.5.1	Quantifications	160
2.5.2	Logical Connectives	160
2.5.3	Atomic Formulas	162
2.5.4	Terms	165
2.6	Identifiers	168

3	Subsorting Specification Semantics	169
3.1	Subsorting Concepts	169
3.1.1	Signatures	169
3.1.2	Models	173
3.1.3	Sentences	174
3.2	Signature Declarations	175
3.2.1	Sorts	175
3.2.2	Datatypes	177
3.3	Axioms	184
3.3.1	Atomic Formulas	184
3.3.2	Terms	187
4	Structured Specification Semantics	189
4.1	Structuring Concepts	189
4.1.1	Institution Independence and the CASL Institution	190
4.1.2	Derived Notions	193
4.1.3	Signature Morphisms	196
4.1.4	Extended Signatures	200
4.1.5	Institution Independent Structuring Concepts	201
4.2	Structured Specifications	204
4.2.1	Translations	205
4.2.2	Reductions	206
4.2.3	Unions	207
4.2.4	Extensions	208
4.2.5	Free Specifications	209
4.2.6	Local Specifications	210
4.2.7	Closed Specifications	210
4.3	Named and Generic Specifications	211
4.3.1	Specification Definitions	211
4.3.2	Specification Instantiation	214
4.4	Views	216
4.4.1	View Definitions	216
4.4.2	Fitting Views	218
4.5	Symbol Lists and Mappings	220
4.5.1	Symbol Lists	221
4.5.2	Symbol Mappings	222
4.6	Compound Identifiers	223
5	Architectural Specification Semantics	227
5.1	Architectural Concepts	228
5.2	Architectural Specification Definitions	232
5.3	Unit Declarations and Definitions	234
5.3.1	Unit Declarations	235
5.3.2	Unit Definitions	236

5.4	Unit Specifications	237
5.4.1	Unit Types	238
5.4.2	Architectural Unit Specifications	239
5.4.3	Closed Unit Specifications	239
5.5	Unit Expressions	240
5.5.1	Unit Terms	242
5.6	Extended Static Semantics	247
5.6.1	Architectural Concepts	248
5.6.2	Architectural Specification Definitions	251
5.6.3	Unit Declarations and Definitions	253
5.6.4	Unit Specifications	255
5.6.5	Unit Expressions	255
5.6.6	Discussion	262
6	Specification Library Semantics	265
6.1	Library Concepts	266
6.2	Local Libraries	268
6.3	Distributed Libraries	270
6.4	Library Names	271

Part IV CASL Logic

Editor: Till Mossakowski (University of Bremen, Germany)

Authors: Till Mossakowski (University of Bremen, Germany),

Piotr Hoffman (Warsaw University, Poland),

Serge Autexier (DFKI Saarbrücken, Germany), and

Dieter Hutter (DFKI Saarbrücken, Germany)

1	Introduction	275
1.1	Institution Independence	276
1.2	Style of the Proof Calculi	277
1.3	Soundness and Completeness	277
2	Basic Specification Calculus	279
3	Subsorting Specification Calculus	287
4	Structured Specification Calculus	289
4.1	Institution Independence	290
4.2	Development Graphs	293
4.3	Translating Development Graphs along Institution Comorphisms	297

4.4	Proof Rules for Development Graphs	298
4.4.1	Hiding Decomposition Rules	299
4.4.2	Conservativity Rules	303
4.4.3	Simple Structural Rules	307
4.5	Soundness and Completeness	308
4.6	Checking Conservativity and Freeness	310
4.7	Translation from Structured Specifications to Development Graphs	311
4.7.1	Concepts for the Verification Semantics	312
4.7.2	Structured Specifications	317
4.7.3	Named and Generic Specifications	320
4.7.4	Views	322
4.7.5	Adequacy of the Translation	324
5	Architectural Specification Calculus	329
5.1	Semantics	330
5.1.1	Static and Model Semantics	330
5.1.2	Extended Static Semantics	334
5.2	Soundness and Completeness of the Extended Static Semantics	338
5.2.1	Concepts	338
5.2.2	Proof	341
5.3	The Proof Calculus	347
5.3.1	Definition of the Proof Calculus	348
5.3.2	Soundness and Completeness	353
6	Specification Library Calculus	357

Part V CASL Libraries

Authors: Markus Roggenbach (University of Wales Swansea, United Kingdom), Till Mossakowski (University of Bremen, Germany), and Lutz Schröder (University of Bremen, Germany)

1	Introduction	363
1.1	A Short Overview of the Specified Datatypes	364
1.2	The Library Basic/Numbers	365
1.3	The Library Basic/RelationsAndOrders	368
1.4	The Library Basic/Algebra_I	369
1.5	The Library Basic/SimpleDatatypes	370
1.6	The Library Basic/StructuredDatatypes	370
1.7	The Library Basic/Graphs	372
1.8	The Library Basic/Algebra_II	374
1.9	The Library Basic/LinearAlgebra_I	375
1.10	The Library Basic/LinearAlgebra_II	377
1.11	The Library Basic/MachineNumbers	377

2	Library Basic/Numbers.....	379
3	Library Basic/RelationsAndOrders	387
4	Library Basic/Algebra_I	393
5	Library Basic/SimpleDatatypes.....	401
6	Library Basic/StructuredDatatypes.....	405
7	Library Basic/Graphs	421
8	Library Basic/Algebra_II	431
9	Library Basic/LinearAlgebra_I.....	439
10	Library Basic/LinearAlgebra_II.....	449
11	Library Basic/MachineNumbers	453
12	Dependency Graphs of the Libraries.....	459

Appendices

Annotated Bibliography	469
References.....	487
Index of Library and Specification Names	491
Abstract Syntax Sorts and Constructors.....	495
Symbol Index.....	501
Concept Index.....	511



<http://www.springer.com/978-3-540-21301-7>

CASL Reference Manual

The Complete Documentation of the Common Algebraic
Specification Language

Mosses, P.D. (Ed.)

2004, XVIII, 534 p., Softcover

ISBN: 978-3-540-21301-7