

## Contents

<i>List of contributors</i>	<i>page</i> vii
<i>Preface</i>	ix
<b>1 John Williams Calkin: a short biography</b> <i>S. Hassi, H.S.V. de Snoo and F.H. Szafraniec</i>	1
<b>2 On Calkin's abstract symmetric boundary conditions</b> <i>S. Hassi and H.L. Wietsma</i>	3
2.1 Introduction	3
2.2 Preliminaries	5
2.3 Reduction operators	10
2.4 Maximal symmetric extensions and unbounded reduction operators	23
<b>3 Boundary triplets and maximal accretive extensions of sectorial operators</b> <i>Y. Arlinskiĭ</i>	35
3.1 Introduction	35
3.2 Preliminaries	38
3.3 Friedrichs and Kreĭn-von Neumann extensions	43
3.4 Boundary pairs and closed forms associated with m-sectorial extensions	45
3.5 Boundary triplets and m-accretive extensions	47
3.6 $W_F$ - and $Q_F$ -functions	52
3.7 Realization of the Phillips boundary space	54
3.8 Vishik-Birman-Grubb type formulas	55
3.9 m-sectorial extensions via fractional-linear transformations	57
3.10 Sectorial operators in divergence form	60
<b>4 Boundary control state/signal systems and boundary triplets</b> <i>D.Z. Arov, M. Kurula and O.J. Staffans</i>	73

4.1	Introduction	73
4.2	Boundary control systems	74
4.3	Conservative state/signal systems in boundary control	76
4.4	An example: the transmission line	78
4.5	The connection to boundary triplets	81
<b>5</b>	<b>Passive state/signal systems and conservative boundary relations</b> <i>D.Z. Arov, M. Kurula and O.J. Staffans</i>	87
5.1	Introduction	87
5.2	Continuous-time state/signal systems	88
5.3	Passive and conservative state/signal systems	94
5.4	The frequency domain characteristics of a s/s system	104
5.5	Conservative boundary relations	107
5.6	Conclusions	116
<b>6</b>	<b>Elliptic operators, Dirichlet-to-Neumann maps and quasi boundary triples</b> <i>J. Behrndt and M. Langer</i>	121
6.1	Introduction	121
6.2	Boundary triples and Weyl functions for ordinary and partial differential operators	126
6.3	Quasi boundary triples and their Weyl functions	135
6.4	Quasi boundary triples for elliptic operators and Dirichlet-to-Neumann maps	147
<b>7</b>	<b>Boundary triplets and Weyl functions. Recent developments</b> <i>V.A. Derkach, S. Hassi, M.M. Malamud and H.S.V. de Snoo</i>	161
7.1	Introduction	161
7.2	Preliminaries	165
7.3	Ordinary boundary triplets	172
7.4	Boundary triplets of bounded type	175
7.5	Boundary triplets of bounded type and infinite dimensional graph perturbations	184
7.6	Unitary boundary relations and Weyl families	188
7.7	Generalized resolvents and unitary boundary triplets	201
7.8	Isometric boundary mappings	205
<b>8</b>	<b>Extension theory for elliptic partial differential operators with pseudodifferential methods</b> <i>G. Grubb</i>	221
8.1	Introduction	221
8.2	Elliptic boundary value problems	222
8.3	Pseudodifferential operators	226

*Contents*

vii

8.4	Pseudodifferential boundary operators	228
8.5	Extension theories	232
8.6	Implementation of the abstract set-up for elliptic operators	237
8.7	Resolvent formulas	243
8.8	Applications of pseudodifferential methods I: Conditions for lower boundedness	244
8.9	Applications of pseudodifferential methods II: Spectral asymptotics	247
8.10	New spectral results	251
<b>9</b>	<b>Dirac structures and boundary relations</b> <i>S. Hassi, A.J. van der Schaft, H.S.V. de Snoo and H.J. Zwart</i>	259
9.1	Introduction	259
9.2	Linear relations in Hilbert and Kreĭn spaces	259
9.3	Linear relations in product spaces	263
9.4	The connections between various structures	268
9.5	Weyl families and transfer functions	271
<b>10</b>	<b>Naĭmark dilations and Naĭmark extensions in favour of moment problems</b> <i>F.H. Szafraniec</i>	275
10.1	Dilations and extensions	276
10.2	The example	287