## Contents

٠

	List of a Preface	contributors pag	<i>je</i> vii ix
1	John V H.S.V.	Villiams Calkin: a short biographyS. Hassi,de Snoo and $F.H.$ Szafraniec	1
<b>2</b>	On Cal	kin's abstract symmetric boundary conditions	
	S. Has.	si and H.L. Wietsma	3
	2.1	Introduction	3
	2.2	Preliminaries	5
	2.3	Reduction operators	10
	2.4	Maximal symmetric extensions and unbounded	
		reduction operators	23
3	Bounda	ary triplets and maximal accretive extensions of	
	sectoria	al operators Y. Arlinskiĭ	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	$W_{\rm F}$ - and $Q_{\rm F}$ -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 trans-	
		formations	57
	3.10	Sectorial operators in divergence form	60
4	$\mathbf{Bounda}$	ary control state/signal systems and boundary D.Z. Arov, M. Kurula and O.J. Staffans	73

Contents
----------

	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>	Passive	state/signal systems and conservative bound-	
	ary rela	tions D.Z. Arov, M. Kurula and O.J. Staffans	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
6	Elliptic	operators, Dirichlet-to-Neumann maps and quas	si
	bounda	ry triples J. Behrndt and M. Langer	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
7	Bounda	ary triplets and Weyl functions. Recent develop-	
	ments	V.A. Derkach, S. Hassi, M.M. Malamud and	
	H.S.V.	de Snoo	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
8	$\mathbf{Extensi}$	ion theory for elliptic partial differential opera-	
	tors wi	${ m th}\ { m pseudodifferential}\ { m methods}\ { m G.}\ { m Grubb}$	221
	8.1	Introduction	<b>221</b>
	8.2	Elliptic boundary value problems	222
	8.3	Pseudodifferential operators	226

vi

Contents	vii
8.4 Pseudodifferential boundary operators	228
8.5 Extension theories	232
8.6 Implementation of the abstract set-up for ellipt	cic
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
9 Dirac structures and boundary relations $S. H$	assi,
A.J. van der Schaft, H.S.V. de Snoo and H.J. Zo	wart 259
9.1 Introduction	259
9.2 Linear relations in Hilbert and Krein 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
10 Naĭmark dilations and Naĭmark extensions in fa	vour
of moment problems F.H. Szafraniec	275
10.1 Dilations and extensions	276
10.2 The example	287