TABLE OF CONTENTS

FO	REWOI	RD	XIII
PR	EFACE		XV
LIS	T OF S	YMBOLS AND ABBREVIATIONS	XIX
Cha	ntov 1		
	pter 1		
INT	RODU	CTION	1
1.1	Genera	al	1
	1.1.1	Aims of the book	1
	1.1.2	Brief description of the contents of the book	10
	1.1.3	Types of structural systems and joints covered	11
	1.1.4	Basis of design	12
1.2	Defini	tions	12
	1.2.1	Joint properties	14
	1.2.2	Sources of joint deformability	15
	1.2.3	Beam splices and column splices	20
	1.2.4	Beam-to-beam joints	21
	1.2.5	Column bases	22
	1.2.6	Composite joints	23
	1.2.7	Hollow section joints	24
1.3	Materi	al choice	26
1.4	Fabrica	ation and erection	28
1.5	Costs		29
1.6	Design	approaches	29
	1.6.1	Application of the "static approach"	29
	1.6.2	Component approach	31
	1.6.3	Hybrid connection aspects	38
1.7	Design	tools	39
	171	Types of design tools	39

TABLE OF CONTENTS

vi

I / 11/			
	1.7.2	Examples of design tools	40
1.8	Worke	ed examples	44
Ch	D		
	pter 2		
STR	RUCTU	RAL ANALYSIS AND DESIGN	47
2.1	Introd	action	47
	2.1.1	Elastic or plastic analysis and verification process	48
	2.1.2	First order or second order analysis	49
	2.1.3	Integration of joint response into the frame analysis	
		and design process	51
2.2	Joint n	nodelling	51
	2.2.1	General	51
	2.2.2	Modelling and sources of joint deformability	54
	2.2.3	Simplified modelling according to Eurocode 3	54
	2.2.4	Concentration of the joint deformability	55
2.3	Joint i	dealisation	60
	2.3.1	Elastic idealisation for an elastic analysis	61
	2.3.2	Rigid-plastic idealisation for a rigid-plastic analysis	62
	2.3.3	Non-linear idealisation for an elastic-plastic analysis	63
2.4	Joint c	lassification	63
	2.4.1	General	63
	2.4.2	Classification based on mechanical joint properties	63
2.5	Ductili	ity classes	66
	2.5.1	General concept	66
	2.5.2	Requirements for classes of joints	69
Cha	pter 3		
	-	IONS WITH MECHANICAL FASTENERS	71
3.1	Mecha	nical fasteners	71
3.2	Catego	ories of connections	73
- · -	3.2.1	Shear connections	73
	3.2.2		75

*************			ABLE OF CONTENTS
3.3	Positio	ning of bolt holes	76
3.4	Design	of the basic components	78
	3.4.1	Bolts in shear	78
	3.4.2	Bolts in tension	80
	3.4.3	Bolts in shear and tension	80
	3.4.4	Preloaded bolts	81
	3.4.5	Plates in bearing	89
	3.4.6	Block tearing	90
	3.4.7	Injection bolts	91
	3.4.8	Pins	92
	3.4.9	Blind bolting	95
	3.4.10	Nails	97
	3.4.11	Eccentricity of angles	98
3.5	Design	of connections	100
	3.5.1	Bolted lap joints	100
	3.5.2	Bolted T-stubs	105
	3.5.3	Gusset plates	117
	3.5.4	Long joints	121
Cha	pter 4		
WE	LDED C	CONNECTIONS	123
4.1	Type o	f welds	123
	4.1.1	Butt welds	123
	4.1.2	Fillet welds	124
	4.1.3	Fillet welds all round	126
	4.1.4	Plug welds	126
4.2	Constru	127	
	4.2.1	Mechanical properties of materials	127
	4.2.2	Welding processes, preparation of welds and w	
		quality	128
	4.2.3	Geometry and dimensions of welds	132
4.3	Design	of welds	135
	4.3.1	Generalities	135
	4.3.2	Fillet welds	136

T	ΔRI	F	OF	CO	NT	ENTS	

viii

140 140 142
142
142
145
145
147
153
153
155
155
156
159
162
174
187
187
189
189
190
191
200
205
205
206

ix

	6.2.2	Column web in transverse compression in steel or	
		composite joints	208
	6.2.3	Column web in transverse tension	212
	6.2.4	Column flange in transverse bending	213
	6.2.5		218
	6.2.6	5	221
	6.2.7	5	223
	6.2.8		225
	6.2.9	Plate in tension or compression	226
	6.2.10	Bolts in tension	227
	6.2.11	Bolts in shear	228
	6.2.12	Bolts in bearing (on beam flange, column flange, end-	
		plate or cleat)	229
	6.2.13	Concrete in compression including grout	230
	6.2.14	Base plate in bending under compression	230
	6.2.15	Base plate in bending under tension	230
	6.2.16	Anchor bolts in tension	231
	6.2.17	Anchor bolts in shear	232
	6.2.18	Anchor bolts in bearing	232
	6.2.19	Welds	232
	6.2.20	Haunched beam	232
	6.2.21	Longitudinal steel reinforcement in tension	233
	6.2.22	Steel contact plate in compression	234
6.3	Assemb	oly for resistance	235
	6.3.1	Joints under bending moments	235
	6.3.2	Joints under axial forces	243
	6.3.3	Joints under bending moments and axial forces	244
	6.3.4	M-N-V	251
	6.3.5	Design of welds	252
6.4	Assemb	oly for rotational stiffness	257
	6.4.1	Joints under bending moments	257
	6.4.2	Joints under bending moments and axial forces	266
6.5	Assemb	oly for ductility	268
	6.5.1	Steel bolted joints	269
	6.5.2	Steel welded joints	271

TABLE OF CONTENTS

	6.6	Application	n to steel beam-to-column joint configurations	272
		6.6.1 Ex	ctended scope	272
		6.6.2 Po	ssible design simplifications for endplate	
		CO	nnections	27 5
		6.6.3 W	orked example	277
	6.7	Application	n to steel column splices	300
		6.7.1 Co	ommon splice configurations	300
		6.7.2 De	esign considerations	302
	6.8	Application	n to column bases	303
		6.8.1 Co	ommon column basis configurations	303
		6.8.2 De	esign considerations	306
	6.9	Application	n to composite joints	314
		6.9.1 Ge	eneralities	314
		6.9.2 De	esign properties	318
		6.9.3 As	sembly procedure under M and N	320
	Cha	pter 7		
	LAT	TICE GIR	DER JOINTS	329
	7.1	General		329
	7.2	Scope and	field of application	330
x	7.3	Design mo	dels	333
		•	eneral	333
		7.3.2 Fa	ilure modes	334
		7.3.3 Mo	odels for CHS chords	335
		7.3.4 Mo	odel for RHS chords	336
		7.3.5 Pu	nching shear failure	338
			odel for brace failure	339
		7.3.7 <i>M</i> -	N interaction	339
	Cha	pter 8		
		•	D VADIOUS LOADING SITUATIONS	341
			R VARIOUS LOADING SITUATIONS	
	8.1	Introductio	n ·	341
	8.2	Composite	joints under sagging moment	342

T		DI	17	OF	co	NTE	me
	Α	BL	ж.	OF.	CO	NIL	VIS

***************************************	***************************************		***************************************			
8.3	Joints	in fire	343			
8.4	Joints under cyclic loading					
8.5	Joints	under exceptional events	346			
Cha	pter 9					
DES	SIGN ST	TRATEGIES	349			
9.1	Design	opportunities for optimisation of joints and frames	349			
	9.1.1	Introduction	349			
	9.1.2	Traditional design approach	352			
	9.1.3	Consistent design approach	355			
	9.1.4	Intermediate design approaches	357			
	9.1.5	Economic considerations	358			
9.2	Applic	ation procedures	364			
	9.2.1	Guidelines for design methodology	364			
	9.2.2	Use of a <i>good guess</i> for joint stiffness	365			
	9.2.3	Required joint stiffness	366			
	9.2.4	Use of the fixity factor concept (traditional design				
		approach)	369			
	9.2.5	Design of non-sway frames with rigid-plastic global				
		frame analysis	370			
BIB	LIOGR	APHIC REFERENCES	375			
Ann	ex A	Practical values for required rotation capacity				
Annex B		x B Values for lateral torsional buckling strength of a fin plate				

κi