Contents

	Foreword	v
	Preface	vi
	Acknowledgments	viii
	Figures	ix
	Introduction	xiii
	Conditions Affecting All Springs	
	Introduction / Factor of Safety / Variations in Mechanical Properties	
2	Spring Materials	11
	General / Chemical Elements / Music Wire Spring Steel / Hard-Drawn MB Spring Steel / Galvanized Wire / Alloy Spring Steels / Stainless Steels / Copper-Base Alloys / Nickel-Base Alloys	
3	Twist Testing Wire	22
	General / Wire Length / Wire Tension / Twist Speed / Number of Twists / Appearance of Fractures / Special Effects / Comparative Testing / Torsion Yield Strength / Observations	
4	Compression Springs	38
	General / Materials / Design	

Foreword

iv	C	ontents
5	Compression Spring Manufacture	46
	Coiling / Heat Treatment / Set Removal / Grinding / Testing / Bucklir Squareness-under-Load Testing / Conical Compression Springs	ng /
6	Extension Springs	£1
	General / Hook Breakage / Failure Analysis of Hook Breakage/ Standard Hooks / Regular Hooks / Crossover Hooks / Half Hooks / Double Loops / Special Hooks / Reduced Hooks / Enlarged Hooks / Long Extended Hooks / Side Hooks / Swivel Hooks / Initial Tension / Stress Relieving / Position of Hooks / Deflection / Dynamic Loads / Vibration / Extension Spring Recommendations	
7	Extension Spring Manufacture	80
	Coiling / Heat Treatment / Looping / Hydrogen Embrittlement / Testing	
8	Torsion Springs	98
	General / Design / Double Torsion / Torsion Bars	
9	Torsion Spring Manufacture	104
	Coiling / Heat Treatment / Secondary Operations / Hairsprings and Mainsprings	
10	Special Springs	110
	General / Flat Springs / Motor Springs / Spiral Springs / Constanť Force Springs / Belleville Washers / Volute Springs / Die Springs / Stock Springs / Hot-Coiled Springs	
11	Failure Analysis	128
	General / Procedure for Failure Analysis / Failure Due to Fatigue / Failure Due to Hydrogen Embrittlement / Failure Due to Sharp Bends / Failure Due to Shock / Failure Due to Faulty Heat Treatmen Failure Due to Noncentral Loading / Other Causes of Failure / Reduc Failures	
	Appendix: Miscellaneous Tables	146
	Bibliography	158
	Symbols	161

165

٠		
	3	d

Index