

CONTENTS

Technical Editor's Preface		vii
Notation		xi
Chapter 1	General fundamentals	1
1.1	The lubrication system	1
1.2	Friction	2
1.3	Wear	7
1.4	Heat transfer	10
1.5	Lubrication fundamentals	12
1.6	Lubricant delivery	20
Chapter 2	Composition and properties of lubricants	29
2.1	Fundamentals	29
2.2	Mineral oil based liquid lubricants	30
2.3	Synthetic liquid lubricants	32
2.4	Pseudo-solid lubricants	34
2.5	Additives	37
2.6	Characteristics of lubricants	39
2.7	Flow characteristics of lubricants	53
2.8	Interaction with other substances	68
2.9	Reactions in mixed lubrication zones	83
2.10	Automotive lubrication testing	97
Chapter 3	Lubrication of components	105
3.1	Sliding bearings	105
3.2	Rolling bearings	113
3.3	Toothed gearing	127
3.4	Wire ropes and chains	150
Chapter 4	Lubrication of industrial machinery	157
4.1	Hydraulic systems	157
4.2	Pumps	167
4.3	Compressors	175
Chapter 5	Lubrication of heat engines	183
5.1	Internal combustion engines	183
5.2	Turbines	209
5.3	Steam engines	227
Chapter 6	Metal working	231
6.1	Types of metal working processes	231
6.2	Coolants of metalcutting (cutting fluids)	237
6.3	Lubricants for chipless forming	248
6.4	Quenching and tempering oils	265
6.5	Classification and specification of metal working fluids	267
6.6	Selection of metal working fluids	269
Chapter 7	Maintenance of oil and emulsions	277
7.1	Setting up a lubrication procedure	277
7.2	Oil care measures	281
7.3	Maintenance of emulsions	300

Chapter 8	Used oil	319
8.1	Fundamentals	319
8.2	Environmentally-significant substances in used oil	319
8.3	Possible methods for disposing of used oils	321
8.4	Disposal within the organization	322
8.5	Dealing with emulsions	323
8.6	Disposal of oil sludges	326
Chapter 9	Industrial hygiene aspects	329
9.1	Fundamentals	329
9.2	Oral effects (digestive system)	329
9.3	The respiratory system	330
9.4	Local effects of skin and mucous membrane	336
9.5	Protective measures	339
Chapter 10	Technical regulation for lubricants	341
10.1	Fundamentals	341
10.2	Test specifications	344
10.3	Standard publications for tribological machine-elements	352
10.4	Tribological standards for motors and engines	354
10.5	Metalworking	355
10.6	Lubricant maintenance	355
10.7	Standards related to used oils	355
Appendix		357
References		365
Index		395