

# CONTENTS

PREFACE

vii

## SECTION 1

CHAPTER 1. GENERAL SPECIFICATION OF THE PROBLEMS. F. KOENIGSBERGER	3
References	25
CHAPTER 2. STATIC AND DYNAMIC STIFFNESS. J. TLUSTY	27
2.1. Criteria for requirements on stiffness	27
2.2. Some basic concepts and notations	28
2.3. Criterion 1—Deformations of the frame caused by weight forces	42
2.4. Criterion 2—Deformations of the structure caused by cutting forces	52
2.5. Criterion 3—Forced vibrations	87
References	111

## SECTION 2

### STABILITY AGAINST CHATTER

CHAPTER 1. GENERAL FEATURES OF CHATTER. J. TLUSTY	115
1.1. The basic pattern of chatter in metal cutting	115
1.2. Principles of self-excitation of vibrations in metal cutting	121
1.3. Influence of various conditions on chatter	124
CHAPTER 2. THE THEORY OF CHATTER AND STABILITY ANALYSIS. J. TLUSTY	133
2.1. Natural and forced vibrations of various systems	133
2.2. Basic theory of self-excited vibration in metal cutting	145
2.3. Further aspects of the theory	163
CHAPTER 3. PROCEDURE IN THE INVESTIGATION OF THE STABILITY OF MACHINE TOOLS. J. TLUSTY and M. POLACEK	179
3.1. Individual steps in the procedure—Directional factors	179
3.2. Cutting tests	187
3.3. Measurement of dynamic data by excitation tests	191
3.4. Evaluation of the tests	203
CHAPTER 4. EXAMPLES OF THE ANALYSIS OF THE STABILITY OF MACHINE TOOLS. J. TLUSTY	213
4.1. Horizontal knee-type milling machines	213
4.2. Vertical knee-type milling machines	232
4.3. Centre lathes	243
4.4. Horizontal milling and boring machine	265
4.5. Vertical lathes	274
CHAPTER 5. DAMPING AND DAMPERS. M. POLACEK	283
5.1. Idealization of damping	283
5.2. Damping in machine tools	284
5.3. Types of energy absorbers	289
5.4. Optimizing of absolute dampers	293
5.5. Examples of the use of dampers	303
5.6. Conclusion	310
CHAPTER 6. CHATTER IN GRINDING. M. POLACEK	311
6.1. Results of experimental research	311
6.2. Theoretical solution	326

## 6.3. Interpretation of the results of the theory

List of Symbols

References

## SECTION 3

<b>CHAPTER 1.</b>	<b>STATIC DEFORMATIONS OF MACHINE TOOL STRUCTURES. N. GORBATOV and J. VALENTA</b>	
	Introduction	345
	1.1. Deformations of machine tool structures	345
	1.2. Basic equations for thin-walled box structures	348
	1.3. Stresses and deformations of closed box structures subjected to bending and shear	350
	1.4. Stresses and deformations produced by a twisting moment	356
	1.5. Deformations and stresses of thin-walled structures with open sections	366
	1.6. The displacements of an arbitrary point in box structures with closed or open section	367
	1.7. Deformations of structures with compliant partitions	369
	1.8. Box structures without partitions	374
	1.9. Box structures with flexurally rigid walls	375
	1.10. Local deformations and stresses in thin-walled box structures	379
	1.11. Correction coefficients for stiffness of thin-walled beams weakened by apertures	389
	1.12. Thin-walled box shells with varying section	393
	1.13. Thin-walled structures on elastic foundations	393
	1.14. Deformation of isotropic and orthotropic rectangular plates	401
	1.15. Deformations of the elastic semi-space loaded on a part of its surface by the pressure $p(x, y)$	411
	1.16. Deformations of the bed of a machine tool	415
	1.17. Preliminary check of the stiffness of a lathe bed	416
	1.18. Deformations of the bed of a horizontal boring machine produced by the weight of the workpiece	431
	1.19. Local deformations of the bed	439
	1.20. Static stiffness of the column of the horizontal boring and milling machine	441
	Appendix	446
	List of symbols	450
	References	450
<b>CHAPTER 2.</b>	<b>STRUCTURAL ANALYSIS. A. COWLEY</b>	451
	2.1. Introduction	451
	2.2. Static Analysis	456
	2.3. Dynamic Analysis	470
	2.4. Application to a Plano-milling Machine Structure	486
	Appendix	504
	References	508