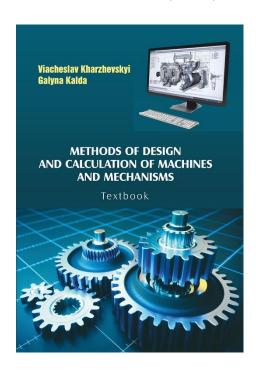
METHODS OF DESIGN AND CALCULATION OF MACHINES AND MECHANISMS

Textbook

Viacheslav Kharzhevskyi, Galyna Kalda



Monografia

słowa kluczowe: mechanizmy sprężeń, dynamika, maszyny, Mathcad, obliczenia inżynierskie, połączenia przekładni

linkage mechanisms, dynamics, machines, Mathcad, engineering calculations, gear connections

© Copyright by Oficyna Wydawnicza Politechniki Rzeszowskiej, Rzeszów 2025

ISBN 978-83-7934-759-9

305 stron

format B5

oprawa twarda

SPIS TREŚCI

Preface

1. Kinematic study of mechanisms

- 1.1. Tasks and methods of kinematic study of mechanisms
- 1.2. Analogs of velocities and accelerations
- 1.3. Analytical study of the kinematics of planar linkage mechanisms by the method of closed vector loops
- 1.4. Group method of analytical study of kinematics of mechanisms
- 1.5. Examples of analytical study of the kinematics of planar linkage in Mathcad using the group method
- 1.6. Analytical study of the kinematics of III class mechanisms

2. Force analysis in linkage mechanisms

- 2.1. The main tasks of the dynamic study of mechanisms
- 2.2. Forces, acting in machines
- 2.3. Definition of inertia forces
- 2.4. Force calculation of planar mechanisms without taking into account friction forces
- 2.5. Force calculation of the II class planar mechanisms using unified subroutines

3. Dynamics of mechanisms and machines

- 3.1. Reduction of forces and moments of forces
- 3.2. Reduction of masses and moments of inertia
- 3.3. Equation of motion of mechanism
- 3.4. Study of the motion of mechanisms by Wittenbauer's method
- 3.5. Unevenness and regulation of movement of mechanisms and machines
- 3.6. Average velocity and coefficient of unevenness of the machine
- 3.7. Determination of the coefficient of unevenness of the machine using Wittenbauer's curve
- 3.8. Determination of the flywheel moment of inertia by Wittenbauer's method

4. Cam mechanisms

- 4.1. General information
- 4.2. Basic parameters of cam mechanisms
- 4.3. Qualitative characteristics of the laws of motion of the output link
- 4.4. Synthesis of cam mechanisms
 - 4.4.1. Synthesis methods and initial data
 - 4.4.2. Synthesis of a cam mechanism with a roller pusher
 - 4.4.3. Synthesis of a cam mechanism with oscillating follower
 - 4.4.4. Synthesis of a cam mechanism with a flat-face follower

5. Gear transmissions

- 5.1. General Information
- 5.2. Geometric parameters of cylindrical involute gears
- 5.3. The main theorem of gearing
- 5.4. Sliding tooth profiles
- 5.5. Properties and equations of the involute of a circle
- 5.6. Theoretical output and forming contours
- 5.7. Calculation of geometric parameters of cylindrical spur gear using the condition of machine tool engagement
- 5.8. Calculation of geometric parameters of cylindrical spur gears using the condition of tight engagement of two gear wheels
- 5.9. Geometry of helical gears
- 5.10. Geometric and kinematic conditions of existence of transmission
 - 5.10.1. Overlap ratio
 - 5.10.2. Undercutting of the teeth
 - 5.10.3. Sharpening of the teeth
 - 5.10.4. Interference of teeth

6. Synthesis of linkage mechanisms

- 6.1. Main tasks of synthesis and methods of their solution
- 6.2. The condition for the existence of a crank in four-bar mechanisms
- 6.3. Synthesis of four-bar linkage mechanisms by two extreme positions of the output link
- 6.4. Synthesis of four-bar linkage mechanisms by the coefficient of change of the average velocity of the output
- 6.5. Examples of the synthesis of 6-bar linkage mechanisms by the coefficient of change of the average velocity and the maximum stroke of the output link

7. Balancing of the mechanisms

- 7.1. The problem of balancing of mechanisms
- 7.2. Determination of the position of the center of mass of a planar mechanism
- 7.3. Method of replacement masses
- 7.4. Balancing of the mechanisms relative to the foundation
 - 7.4.1. Conditions for balancing of the mechanisms
 - 7.4.2. Complete balancing of the inertial forces of the mechanism
- 7.5. Balancing of rotating masses

8. Mathcad in engineering calculations

- 8.1. General characteristics of the Mathcad software package
- 8.2. Structure of the Mathcad package
- 8.3. Interface of the Mathcad package
- 8.4. Setting up the workspace
- 8.5. Working with text
- 8.6. Calculating the values of arithmetic expressions
- 8.7. Built-in functions and user-defined functions
- 8.8. Representation of range variables in Mathcad
- 8.9. Plotting graphs
- 8.10. Plotting graphics of surfaces and spatial curves
- 8.11. Vectors and matrices
- 8.12. Linear equations and systems of equations
- 8.13. Finding derivatives and integrals
- 8.14. Finding extrema of a function and series
- 8.15. Programming in Mathcad

References

Appendix A