
Solved Problems
MACHINE ELEMENTS
Volume 2

İ. Hüseyin Filiz

Professor

Gaziantep
2024



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ISBN 978-625-399-995-7	Page and Cover Design Typesetting and Cover Design by Akademisyen
Book Title Solved Problems Machine Elements Volume 2	Publisher Certificate Number 47518
Author İ. Hüseyin FİLİZ ORCID iD: 0000-0002-3870-1334	Printing and Binding Vadi Printingpress
Publishing Coordinator Yasin DİLMEN	Bisac Code TEC000000
	DOI 10.37609/akya.2789

Library ID Card
Filiz, İ. Hüseyin.
Solved Problems Machine Elements Volume 2 / İ. Hüseyin Filiz.
Ankara : Akademisyen Yayınevi Kitabevi, 2024.
480 p. : figure, table. ; 160x235 mm.
Includes Reference and Appendix.
ISBN 9786253999957
1. Technology--Machine.

GENERAL DISTRIBUTION

Akademisyen Kitabevi AŞ

Halk Sokak 5 / A Yenışehir / Ankara

Tel: 0312 431 16 33

siparis@akademisyen.com

www.akademisyen.com

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to my mother Şükriye Filiz
and
to my father M. Sait Filiz

PREFACE

This book has been prepared for mechanical engineering students who are taking a course of Mechanical Engineering Design. Methodic approaches for the solution of the problems on machine elements have been provided. Most of the problems are selected from previous years' examinations sheets.

The Author's previous book " Problems on the Design of Machine Elements" is rearranged, introductory sections of the Chapters have been extended, different types of problems are added and an effort is made to make the examples more practical. Owing to an increased volume of the contents, it was considered to be more practical and usable to present the book in two parts.

First part (volume 1) was devoted to the subjects : stress analysis, deflection analysis, designing for static strength, designing for fatigue strength, tolerances and fits, design of power screws, design of bolted joints, design of riveted joints and design of welded joints.

This, second part (volume 2) is devoted to the subjects: design of mechanical springs, selection of anti-friction bearings, design of journal bearings, gearing and kinematic analysis of gear trains, design of spur gears, design of helical gears, design of worm gears, design of bevel gears, design of brakes and selection of flexible mechanical elements such as belts, chains and wire ropes.

The subjects are treated in separate sections and they are incorporated with introductory sections in which design and/or selection principles of the

respective elements are briefly discussed by emphasizing important points in the design. At the end of each section some selected problems are also included for the students to study some other problems by themselves.

SI units are used in this book. Standard tables for Materials are not included, but material properties are stated in the problems. Some design factors used in the solution of the problems may be found in the figures and tables given in the Appendix. They are adopted from some of the references given at the end of the book. The reasons of including the tables and figures are first, to give the students the opportunity to find the numerical values of some of the design factors without needing any other source and second, to be consistent with the text used in Machine Elements Courses.

I take this opportunity to thank my friends, for their encouragement in preparing this book. I would like to thank to my undergraduate and graduate students for their criticism and suggestions and reading some part of the manuscript. I am indebted also Mr. Hacı Çelik, Instructor in Gaziantep Vocational School of Higher Education, for his contribution in designing the cover pages of my books.

Special appreciation is extended to my wife Prof. Dr. Ayten Filiz and my daughters Gökçe and Bilge for their continuous support throughout my academic life.

July 2024

Dr. I. Hüseyin Filiz

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LIST OF SYMBOLS

A	Area; constant
a	constant; dimension
B	constant
b	constant; fatigue strength exponent
C	coefficient; spring index; column-end condition constant; center distance
c	clearance; distance
cw	clockwise
ccw	counterclockwise
D,d	Diameter
E	Modulus of elasticity
e	Eccentricity; efficiency; strain value;
F	Force; face width
f	Frequency; coefficient of friction
G	Shear modulus of elasticity
g	Gravitational constant
H	Hardness number; power
I	Moment of inertia
J	Polar moment of inertia
K	Stress concentration factor;
k	Spring scale; endurance limit modifying factor; radius of gyration; stiffness

List of Symbols

L	Length; life; lead
l	Length
M	Moment
m	Mass; margin of safety; speed ratio
N	Number
n	Rotational speed; number of start; factor of safety
P	Force; unit load
p	Pressure; circular pitch
q	Notch sensitivity factor
R	Reaction forces; radius
r	Radius
S	Strength;
T	Torque
t	Thickness
U	Energy
u	Unit energy
V	Shear force; velocity
W	Weight; width; load; force
x	Distance
y	Distance; Lewis form factor
α	Angle; axial fatigue stress concentration factor
γ	shear strain
δ	Deformation; deflection
ε	Unit strain; efficiency
θ	angle of rotation, angle
λ	Lead angle
μ	Poisson's ratio; coefficient of friction
ρ	Radius of curvature
σ	Normal stress
τ	Shear stress

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