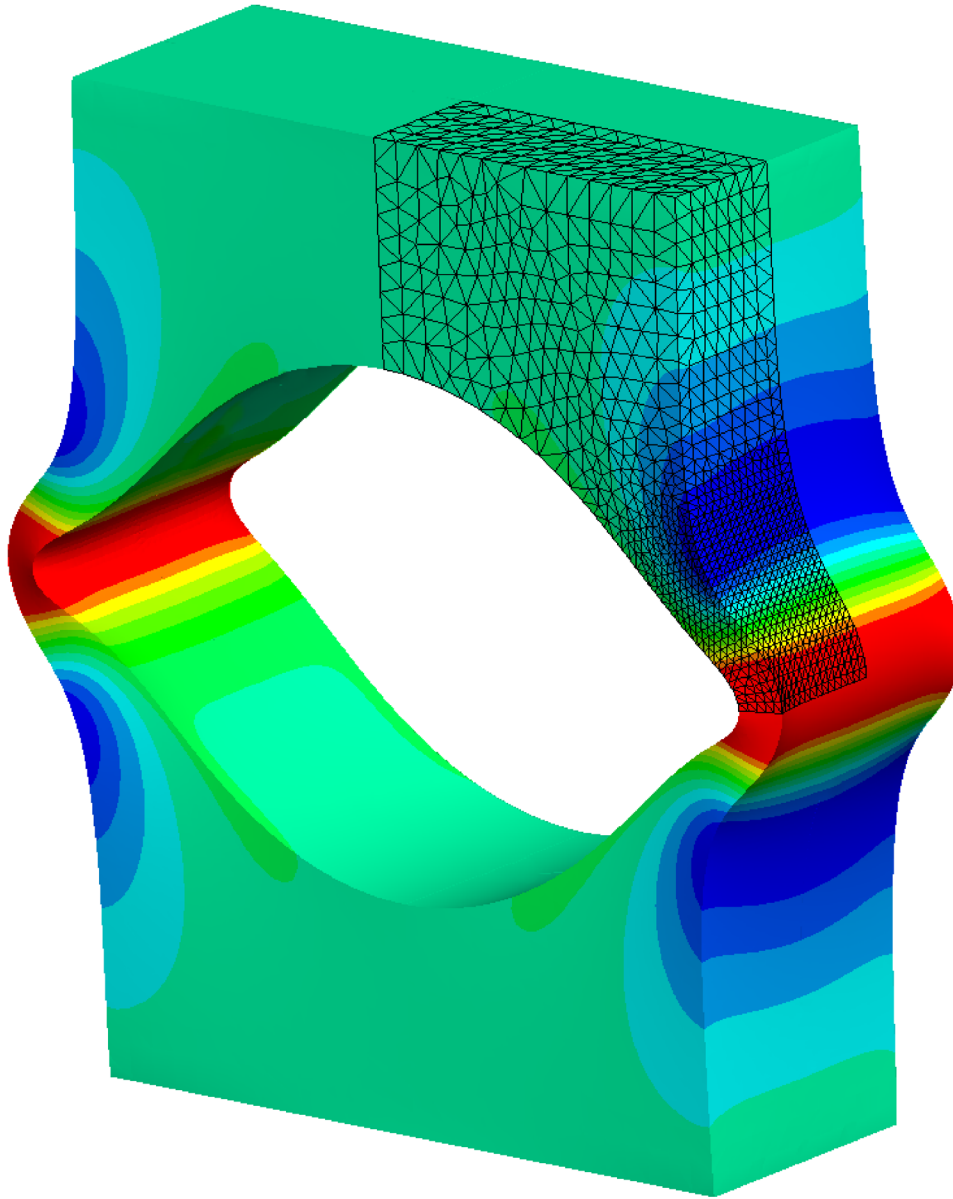


Engineering Analysis

with SOLIDWORKS® Simulation 2020



Paul M. Kurowski



CERTIFIED
Solution
Partner

 SOLIDWORKS



Better Textbooks. Lower Prices.
www.SDCpublications.com

Visit the following websites to learn more about this book:



amazon.com

Google books

BARNES & NOBLE

Table of contents

About the Author	i
Acknowledgements	i
Table of contents	ii
Before You Start	1
Notes on hands-on exercises and functionality of SOLIDWORKS Simulation	
Prerequisites	
Selected terminology	
Graphics	
1: Introduction	5
What is Finite Element Analysis?	
Finite Element Analysis used by Design Engineers	
Objectives of FEA for Design Engineers	
What is SOLIDWORKS Simulation?	
Fundamental steps in an FEA project	
Errors in FEA	
A closer look at finite elements	
What is calculated in FEA?	
How to interpret FEA results	
Units of measure	
Using online help	
Limitations of Static studies	
2: Static analysis of a plate	31
Using the SOLIDWORKS Simulation interface	
Linear static analysis with solid elements	
Controlling discretization error with the convergence process	
Finding reaction forces	
Presenting FEA results in a desired format	
3: Static analysis of an L-bracket	79
Stress singularities	
Differences between modeling errors and discretization errors	
Using mesh controls	

Analysis in different SOLIDWORKS configurations
Nodal stresses, element stresses

4: Static and frequency analyses of a pipe support	99
Use of shell elements	
Frequency analysis	
Bearing load	
5: Static analysis of a link	125
Symmetry boundary conditions	
Preventing rigid body motions	
Limitations of the small displacements theory	
6: Frequency analysis of a tuning fork and a plastic part	135
Frequency analysis with and without supports	
Rigid body modes	
The role of supports in frequency analysis	
Symmetric and anti-symmetric modes	
7: Thermal analysis of a pipe connector and a heater	143
Analogies between structural and thermal analysis	
Steady state thermal analysis	
Analysis of temperature distribution and heat flux	
Thermal boundary conditions	
Thermal stresses	
Vector plots	
8: Thermal analysis of a heat sink	163
Analysis of an assembly	
Global and local Contact conditions	
Steady state thermal analysis	
Transient thermal analysis	
Thermal resistance layer	
Use of section views in result plots	
9: Static analysis of a hanger	179
Global and local Contact conditions	
Hierarchy of Contact conditions	
10: Thermal stress analysis of a bi-metal loop	195
Thermal deformation and thermal stress analysis	

Eliminating rigid body motions	
Converting Sheet Metal bodies to Solid bodies	
"Parasolid" round trip	
Saving model in deformed shape	
11: Buckling analysis of an I-beam	207
Buckling analysis	
Buckling load safety factor	
Stress safety factor	
12: Static analysis of a bracket using adaptive solution methods	215
h-adaptive solution method	
p-adaptive solution method	
Comparison between h-elements and p-elements	
13: Drop test	233
Drop test analysis	
Stress wave propagation	
Direct time integration solution	
14: Selected nonlinear problems	245
Large displacement analysis	
Analysis with shell elements	
Membrane effects	
Following and non-following load	
Nonlinear material analysis	
Residual stress	
15: Mixed meshing problem	289
Using solid and shell elements in the same mesh	
Mixed mesh compatibility	
Manual and automatic finding of contact sets	
Shell Manager	
16: Analysis of weldments using beam and truss elements	303
Different levels of idealization implemented in finite elements	
Preparation of a SOLIDWORKS model for analysis with beam elements	
Beam elements and truss elements	
Analysis of results using beam elements	
Limitations of analysis with beam elements	

17: Review of 2D problems	331
Classification of finite elements	
2D axi-symmetric element	
2D plane stress element	
2D plane strain element	
18: Vibration analysis - modal time history and harmonic	369
Modal Time History analysis (Time Response)	
Harmonic analysis (Frequency Response)	
Modal Superposition Method	
Damping	
19: Analysis of random vibration	399
Random vibration	
Power Spectral Density	
RMS results	
PSD results	
Modal excitation	
20: Topology Optimization	419
Definition of Topology Optimization	
Design space	
Goals and constraints	
Topology Optimization criteria	
Examples of Topology Optimization	
21: Miscellaneous topics – part 1	439
Mesh quality	
Solvers and solvers options	
Displaying mesh in result plots	
Automatic reports	
E drawings	
Non uniform loads	
Frequency analysis with pre-stress	
Interference fit analysis	
Rigid connector	
Pin connector	
Bolt connector	
Remote load/mass	
Weld connector	
Bearing connector	

Cyclic symmetry	
Strongly nonlinear problem	
Submodeling	
Automated detection of stress singularities	
Stress averaging at mid-side nodes	
Terminology issues in the Finite Element Analysis	
22: Miscellaneous topics – part 2	511
Symmetry	
Antisymmetry	
Displacement and stress singularities	
Shell elements	
2D problems	
23: Implementation of FEA into the design process	561
Verification and Validation of FEA results	
FEA driven design process	
FEA project management	
FEA project checkpoints	
FEA reports	
24: Glossary of terms	581
25: Resources available to FEA users	589
26: List of exercises	593