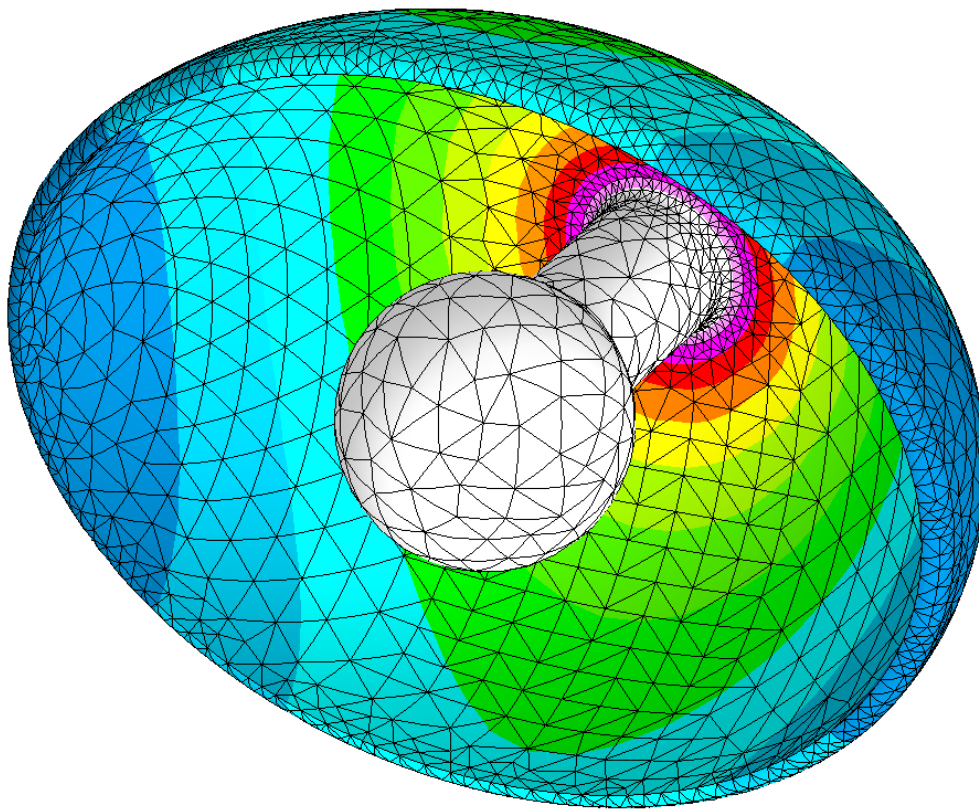


Thermal Analysis

with SOLIDWORKS® Simulation 2019
and Flow Simulation 2019



Paul M. Kurowski



Design Generator Inc.

CERTIFIED
Solution
Partner



Better Textbooks. Lower Prices.
www.SDCpublications.com

Visit the following websites to learn more about this book:



[amazon.com](https://www.amazon.com)

[Google books](https://books.google.com)

[BARNES & NOBLE](https://www.barnesandnoble.com)

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 Simulation	
Prerequisites	
Selected terminology	
1: Introduction	5
Heat transfer by conduction	
Heat transfer by convection	
Heat transfer by radiation	
Thermal boundary conditions	
Analogies between thermal and structural analysis	
Thermal elements: solids and shells	
Scalar and vector entities, presenting results	
Steady state thermal analysis	
Transient thermal analysis	
Linear thermal analysis	
Nonlinear thermal analysis	
2: Hollow plate	21
Heat transfer by conduction	
Heat transfer by convection	
Different ways of presenting results of thermal analysis	
Convergence analysis in thermal problems	
Solid elements in heat transfer problems	
Shell elements in heat transfer problems	
3: L bracket	33
Heat transfer by conduction	
Use of 2D models	
Singularities in thermal problems	

4: Thermal analysis of a round bar	41
Heat transfer by conduction	
Thermal conductivity	
Heat transfer by convection	
Convection boundary conditions	
Thermal resistance	
Prescribed temperature boundary conditions	
Heat power	
Heat flux	
5: Floor heating duct – part 1	57
Heat transfer by conduction	
Prescribed temperature boundary conditions	
Heat power	
Heat flux	
Heat flux singularities	
Analogies between structural and thermal analysis	
6: Floor heating duct – part 2	75
Heat transfer by convection	
Free and forced convection	
Convection coefficient	
Ambient (bulk) temperature	
7: Hot plate	85
Transient thermal analysis	
Conductive heat transfer	
Convective heat transfer	
Heat power	
Thermostat	
Thermal inertia	
8: Thermal stress analysis of a coffee mug	101
Transient thermal analysis	
Thermal stress analysis	
Thermal symmetry boundary conditions	
Structural symmetry boundary conditions	
Use of soft springs	

9: Thermal buckling analysis of a link	113
Buckling caused by thermal effects	
Interpretation of Buckling Load Factor	
10: Thermal analysis of a heat sink	123
Analysis of an assembly	
Thermal contact conditions	
Steady state thermal analysis	
Transient thermal analysis	
Thermal resistance layer	
Thermal symmetry boundary conditions	
11: Radiative power of a black body	139
Heat transfer by radiation	
Emissivity	
Black body	
Radiating heat out to space	
Transient thermal analysis	
Heat power	
Heat energy	
12: Radiation of a hemisphere	151
Heat transfer by radiation	
Emissivity	
Radiating heat out to space	
View factors	
Heat power	
13: Radiation between two bodies	159
Heat transfer by radiation	
Emissivity	
Radiating heat out to space	
View factors	
Heat power	
Closed system	
Open system	

14: Heat transfer with internal fluid flow	173
Introduction to Flow Simulation	
Using Flow Simulation for finding convection coefficients in internal fluid flow	
Interfacing between Flow Simulation and Thermal analysis	
Interfacing between Flow Simulation and structural (Static) analysis	
15: Heat transfer with external fluid flow	217
Using Flow Simulation for finding convection coefficients in external fluid flow	
Interfacing between Flow Simulation and Thermal analysis	
16: Radiative Heat Transfer	235
Radiative heat transfer problem analyzed with Thermal Study in Simulation	
Radiative heat transfer problem analyzed with Flow Simulation	
17: NAFEMS Benchmarks	255
Importance of benchmarks	
One dimensional heat transfer with radiation	
One dimensional transient heat transfer	
Two dimensional heat transfer with convection	
18: Summary and miscellaneous topics	273
Summary of exercises in chapters 1-13	
Nonlinear transient problems	
Advanced options of thermal study	
Closing remarks	
19: Glossary of terms	291
20: References	293
21: List of exercises	295