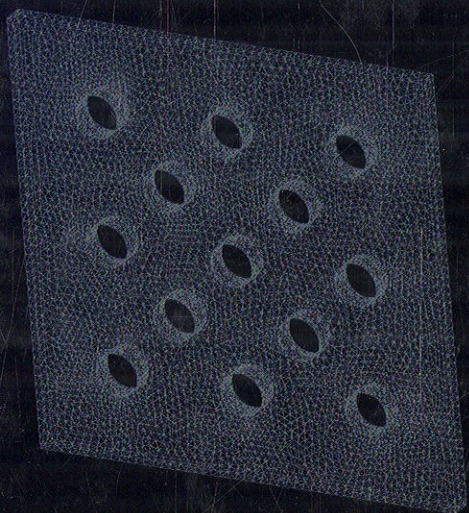
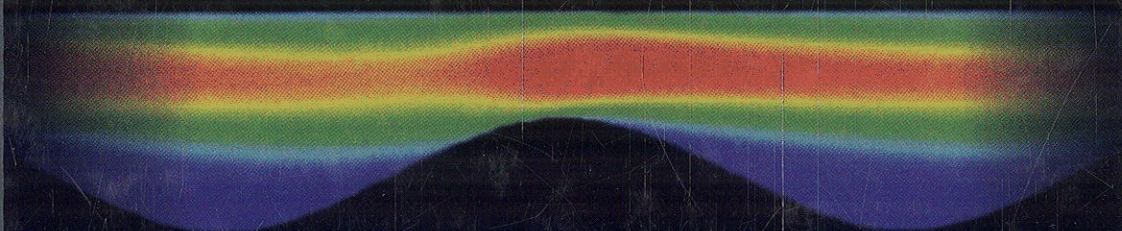
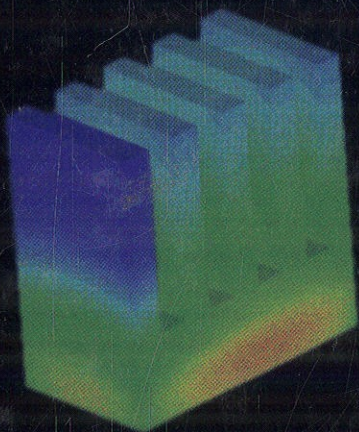


Finite Element Simulations Using ANSYS



Esam M. Alawadhi



CRC Press
Taylor & Francis Group

Contents

Preface.....	v
Acknowledgments.....	vii
Chapter 1 Introduction.....	1
1.1 Finite Element Method.....	1
1.2 Element Types.....	4
1.3 Symmetries in Models.....	5
1.4 Introduction to ANSYS.....	8
Chapter 2 Trusses.....	15
2.1 Development of Bar Elements.....	15
2.2 Analyzing a Bar–Truss Structure.....	23
2.3 Development of Horizontal Beam Elements.....	36
2.4 Analyzing a Horizontal Beam Structure.....	42
2.5 Beam–Truss Structure under a Transient Loading.....	56
Problems.....	74
Chapter 3 Solid Mechanics and Vibration.....	79
3.1 Development of Plane Stress–Strain Elements.....	79
3.2 Stress Concentration of a Plate with Hole.....	90
3.3 Displacement Analysis of a Vessel.....	106
3.4 Three-Dimensional Stress Analyses of I-Beams.....	118
3.5 Contact Element Analysis of Two Beams.....	130
3.6 Vibration Analysis.....	147
3.7 Modal Vibration for a Plate with Holes.....	151
3.8 Harmonic Vibration for a Plate with Holes.....	169
3.9 Higher-Order Elements.....	175
Problems.....	178
Chapter 4 Heat Transfer.....	183
4.1 Introduction to Heat Conduction.....	183
4.2 Finite Element Method for Heat Transfer.....	186
4.3 Thermal Analysis of a Fin and a Chip.....	188
4.4 Unsteady Thermal Analyses of Fin.....	206
4.5 Phase Change Heat Transfer.....	222
Problems.....	239

Chapter 5	Fluid Mechanics	245
5.1	Governing Equations for Fluid Mechanics.....	245
5.2	Finite Element Method for Fluid Mechanics.....	248
5.3	Flow Development in a Channel.....	250
5.4	Flow around a Tube in a Channel.....	269
	Problems.....	292
Chapter 6	Multiphysics	295
6.1	Introduction	295
6.2	Thermal and Structural Analysis of a Thermocouple.....	296
6.3	Chips Cooling in a Forced Convection Domain.....	312
6.4	Natural Convection Flow in a Square Enclosure.....	337
6.5	Oscillations of a Square-Heated Cylinder in a Channel.....	356
	Problems.....	376
Chapter 7	Meshing Guide	381
7.1	Mesh Refinement	381
7.2	Element Distortion.....	383
7.3	Mapped Mesh	384
7.4	Mapped Mesh with ANSYS	387
	Problems.....	397
Bibliography		401
Index		403