**Computation of Nonlinear Structures. Extremely Large Elements for Frames, Plates and Shells**

**Description:**
Comprehensively introduces linear and nonlinear structural analysis through mesh generation, solid mechanics and a new numerical methodology called c-type finite element method.
- Takes a self-contained approach of including all the essential background materials such as differential geometry, mesh generation, tensor analysis with particular elaboration on rotation tensor, finite element methodology and numerical analysis for a thorough understanding of the topics.
- Presents for the first time in closed form the geometric stiffness, the mass, the gyroscopic damping and the centrifugal stiffness matrices for beams, plates and shells.
- Includes numerous examples and exercises.
- Presents solutions for locking problems.

**Contents:**

Acknowledgements xi

1 Introduction: Background and Motivation 1
1.1 What This Book Is All About 1
1.2 A Brief Historical Perspective 2
1.3 Symbiotic Structural Analysis 9
1.4 Linear Curved Beams and Arches 9
1.5 Geometrically Nonlinear Curved Beams and Arches 10
1.6 Geometrically Nonlinear Plates and Shells 11
1.7 Symmetry of the Tangent Operator: Nonlinear Beams and Shells 12
1.8 Road Map of the Book 14

References 15

Part I ESSENTIAL MATHEMATICS 19

2 Mathematical Preliminaries 21
2.1 Essential Preliminaries 21
2.2 Affine Space, Vectors and Barycentric Combination 33
2.3 Generalization: Euclidean to Riemannian Space 36
2.4 Where We Would Like to Go 40

3 Tensors 41
3.1 Introduction 41
3.2 Tensors as Linear Transformation 44
3.3 General Tensor Space 46
3.4 Tensor by Component Transformation Property 50
3.5 Special Tensors 57
3.6 Second–order Tensors 62
3.7 Calculus Tensor 74
3.8 Partial Derivatives of Tensors 74
3.9 Covariant or Absolute Derivative 75
3.10 Riemann Christoffel Tensor: Ordered Differentiation 78
3.11 Partial (PD) and Covariant (C.D.) Derivatives of Tensors 79
3.12 Partial Derivatives of Scalar Functions of Tensors 80
3.13 Partial Derivatives of Tensor Functions of Tensors 81
3.14 Partial Derivatives of Parametric Functions of Tensors 81
3.15 Differential Operators 82
3.16 Gradient Operator: GRAD( ) or ( ) 82
3.17 Divergence Operator: DIV or 84
3.18 Integral Transforms: Green Gauss Theorems 87
3.19 Where We Would Like to Go 90
4 Rotation Tensor 91
4.1 Introduction 91
4.2 Cayley’s Representation 100
4.3 Rodrigues Parameters 107
4.4 Euler Rodrigues Parameters 112
4.5 Hamilton’s Quaternions 115
4.6 Hamilton Rodrigues Quaternion 119
4.7 Derivatives, Angular Velocity and Variations 125
Part II ESSENTIAL MESH GENERATION 133
5 Curves: Theory and Computation 135
5.1 Introduction 135
5.2 Affine Transformation and Ratios 136
5.3 Real Parametric Curves: Differential Geometry 139
5.4 Frenet Serret Derivatives 145
5.5 Bernstein Polynomials 148
5.6 Non-rational Curves Bezier Bernstein de Casteljau 154
11.5 Static and Dynamic Equations: Engineering Approach 771
11.6 Weak Form: Kinematic and Configuration Space 783
11.7 Admissible Virtual Space: Curvature, Velocity and Variation 788
11.8 Real Strain and Strain Rates from Weak Form 799
11.9 Component or Operational Vector Form 810
11.10 Covariant Derivatives of Component Vectors 817
11.11 Computational Equations of Motion: Component Vector Form 820
11.12 Computational Derivatives and Variations 830
11.13 Computational Virtual Work Equations 841
11.14 Computational Virtual Work Equations and Virtual Strains: Revisited 851
11.15 Computational Real Strains 861
11.16 Hyperelastic Material Property 864
11.17 Covariant Linearization of Virtual Work 877
11.18 c-type FE Formulation: Dynamic Loading 891
11.19 c-type FE Formulation: Quasi-static Loading 914
11.20 c-type FE Implementation and Examples: Quasi-static Loading 930
Index 967
Fax Order Form
To place an order via fax simply print this form, fill in the information below and fax the completed form to 646-607-1907 (from USA) or +353-1-481-1716 (from Rest of World). If you have any questions please visit http://www.researchandmarkets.com/contact/

Order Information
Please verify that the product information is correct.

Product Name: Computation of Nonlinear Structures. Extremely Large Elements for Frames, Plates and Shells
Web Address: http://www.researchandmarkets.com/reports/3024934/
Office Code: SCDKLGLR

Product Format
Please select the product format and quantity you require:

Quantity
Hard Copy (Hard Back): ☐ USD 162 + USD 29 Shipping/Handling

* Shipping/Handling is only charged once per order.

Contact Information
Please enter all the information below in BLOCK CAPITALS

Title: Mr ☐ Mrs ☐ Dr ☐ Miss ☐ Ms ☐ Prof ☐
First Name: ___________________________________________ Last Name: ___________________________________________
Email Address: * ________________________________
Job Title: __________________________________________
Organisation: ______________________________________
Address: __________________________________________
City: __________________________________________
Postal / Zip Code: __________________________________
Country: ______________________________________
Phone Number: ____________________________________
Fax Number: ______________________________________

* Please refrain from using free email accounts when ordering (e.g. Yahoo, Hotmail, AOL)
Payment Information

Please indicate the payment method you would like to use by selecting the appropriate box.

☐ Pay by credit card: You will receive an email with a link to a secure webpage to enter your credit card details.

☐ Pay by check: Please post the check, accompanied by this form, to:
Research and Markets,
Guinness Center,
Taylors Lane,
Dublin 8,
Ireland.

☐ Pay by wire transfer: Please transfer funds to:
Account number 833 130 83
Sort code 98-53-30
Swift code ULSBIE2D
IBAN number IE78ULSB98533083313083
Bank Address Ulster Bank,
27-35 Main Street,
Blackrock,
Co. Dublin,
Ireland.

If you have a Marketing Code please enter it below:

Marketing Code: ________________________________

Please note that by ordering from Research and Markets you are agreeing to our Terms and Conditions at http://www.researchandmarkets.com/info/terms.asp

Please fax this form to:
(646) 607-1907 or (646) 964-6609 - From USA
+353-1-481-1716 or +353-1-653-1571 - From Rest of World