Many processes in materials science and engineering, such as the load deformation behavior of certain solids and structures, exhibit nonlinear characteristics. The computer simulation of such processes therefore requires a deep understanding of both the theoretical aspects of nonlinearity and the associated computational techniques.

This book provides a complete set of exercises and solutions in the field of theoretical and computational nonlinear continuum mechanics, and is the perfect companion to *Nonlinear Continuum Mechanics for Finite Element Analysis*, where the authors set out the theoretical foundations of the subject. It employs notation consistent with the theory book and serves as a great resource to students, researchers, and those in industry interested in gaining confidence by practicing through examples. Instructors of the subject will also find the book indispensable in aiding student learning.

JAVIER BONET is a Professor of Engineering and the Head of the College of Engineering at Swansea University, and a visiting Professor at the Universitat Politecnica de Catalunya in Spain. He has extensive experience teaching topics in structural mechanics, including large strain nonlinear solid mechanics, to undergraduate and graduate engineering students. He has been active in research in the area of computational mechanics for more than 25 years, with contributions in modeling superplastic forming, large strain dynamic analysis, membrane modeling, finite element technology including error estimation, and meshless methods (smooth particle hydrodynamics). He has given invited, keynote, and plenary lectures at numerous international conferences.

ANTONIO J. GIL is a Senior Lecturer in the world-leading Civil and Computational Engineering Centre at Swansea University. To date, he has published 50 papers in various areas of computational mechanics, covering the areas of computational simulation of nanomembranes, biomembranes (heart valves) and superplastic forming of medical prostheses, modeling of smart electro-magneto-mechanical devices, and numerical analysis of fast transient dynamical phenomena. He currently leads an interdisciplinary research group of doctoral and postdoctoral researchers comprising mathematicians, engineers, and computer scientists. Having been awarded the National 1st Prize by the Spanish Ministry of Education in 2000, he has since received a number of other research prizes both as Principal Investigator and Ph.D. supervisor in the field of computational mechanics, including the UK 2011 Philip Leverhulme Prize to young researchers for his contributions in computational modeling.

RICHARD D. WOOD is an Honorary Research Fellow in the Civil and Computational Engineering Centre at Swansea University. He has more than 25 years' experience teaching the course Nonlinear Continuum Mechanics for Finite Element Analysis at Swansea University, which he originally developed at the University of Arizona. The same course is now taught by his co-author, Antonio J. Gil. Dr. Wood's academic career has focused on finite element analysis, Swansea University being one of the original major international centers to develop the subject.

To Catherine, Clare and Doreen

WORKED EXAMPLES IN NONLINEAR CONTINUUM MECHANICS FOR FINITE ELEMENT ANALYSIS

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PREFACE

This worked examples text is intended primarily as a companion to the second edition of the textbook *Nonlinear Continuum Mechanics for Finite Element Analysis* by Javier Bonet and Richard D. Wood. However, to be reasonably self-contained, where necessary key equations from the textbook are replicated in each chapter.

Textbook equation numbers given at the beginning of each chapter are indicated in square brackets.

Exercises are presented in a mix of direct (tensor), matrix, or indicial notation, whichever provides the greater clarity. Indicial notation is used only when strictly necessary and with summations clearly indicated.

The textbook is augmented by a website, www.flagshyp.com, which contains corrections, software, and sample input data. Updates to this worked examples text will also be included on the website as necessary.