

# Preface

During the past two decades research in the field of computational mechanics has progressed remarkably, mainly because of the development of a sound mathematical background and the introduction of new efficient computational strategies. Beyond the classical finite element method, several innovative techniques and novel approaches for the analysis of microstructural evolution, growth, damage, and structural failure in multi-field and multi-scale problems have emerged vigorously.

With the aim to discuss different computational strategies for multi-field and multi-scale problems, a remarkable group of scientists gathered in September 2014 to the IUTAM symposium “Innovative numerical approaches for materials and structures in multi-field and multi-scale problems”. Hosted by the University of Siegen, the venue of the symposium was the Castle Burg Schnellenberg, a mighty fortress located in the green heart of Westphalia, Germany. There we discussed the new horizons and perspectives of multi-field applied mechanics. The symposium covered a large domain of recent research, from computational materials modeling, crystal plasticity, micro-structured materials, and biomaterials to multi-scale simulations of multi-physics phenomena. The pioneering discretization methods for the solution of coupled nonlinear problems at different length scales were particularly emphasized.

The special occasion that motivated the organization of the symposium was the 60th birthday of Professor Michael Ortiz. Along his exceptional career, Michael Ortiz has been at the forefront of computational mechanics, his work being a constant source of inspiration for many. All participants of this symposium are grateful to Michael Ortiz for being such an enthusiastic collaborator, a reliable colleague, an illuminating scientist, and a valuable friend.

The friendship and fellow-feeling felt during the symposium inspired the idea to collect the presentations of some of the convened researchers in a special book. Our choice was to organize a book as part of the series ‘Lecture Notes in Applied and Computational Mechanics’ (LNACM), which aims to document new high-level developments in applied and computational mechanics. We are happy to present here 13 high-quality contributions of current and past collaborators of Michael

Ortiz. All contributions have undergone full peer review, and we take the occasion to thank the reviewers for their valuable comments.

It is our hope that the present volume will give the reader an insight into the exciting new developments of computational solid mechanics which is still wide open to discovery. The book attempts to provide a flavor of this challenging field and to contribute to its popularity within the mechanics and physics communities.

Siegen  
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