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PREFACE

It has been already recognized in the XXth century that many structural materials possess either natural or artificially created inhomogeneities which must be accounted for in continuous models. These are, for instance, polycrystals, composite materials, dense structures such as grids, porous and granular materials and many others. Mathematical methods developed for the description of such materials were designed for transition from microstructural properties to effective macroscopic parameters describing their behaviour. Three main ways have been extensively discussed: volume averaging, homogenization and numerical approximations. In spite of a very extensive research (for a very competent review see, for example, the book by Greame W. Milton, *The Theory of Composites,* Cambridge University Press, 2004). many important issues are not even alluded. It is the main aim of the series of conferences "*Mechanics of Inhomogeneous Media*" held in Łagów (Poland) to present the progress in this field. As a result of the first conference in this series the book "*Selected Topics in the Mechanics of Inhomogeneous Media"* edited by Czesław Woźniak, Romuald Świtka and Mieczysław Kuczma was published in 2006 by the University of Zielona Góra.

In 2008 the second conference of this series was held and the present book contains articles which were presented at this conference. It is a multi-author work of 20 individual Chapters written by 33 scientists.

Three main topics corresponding to three Parts of the book are covered:

1. Mathematical methods and modelling,
2. Coupled fields,
3. Theory of materials and structures.

The most important method discussed within the first topic is the method of tolerance in various applications to functionally graded materials. However, the classical problems of optimization of inhomogeneous materials and homogenization based on some compatibility conditions are also presented.

Within the second topic, modelling by an extended number of fields is presented. These are, for instance, multicomponent macroscopic continuous models. Finally, within the third topic, some particular problems of systems whose microstructure persists in macroscopic models are discussed. These are, for example, materials with nanotubes, periodically ribbed plates, or brick masonry.

The editors of this volume would like to express their gratitude to the Authors for preparing the papers in the form of self-contained Chapters and for their cooperation in editing this volume.

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