Current Topics in Continuum Mechanics,
Edited by Lazăr Dragoş,

Introduction

The high level didactic activity cannot be separated from a sustained research activity. The most efficient framework in which these activities may simultaneously develop has been acknowledged to be the scientific seminars. The understanding of the importance of this form of interweaving between teaching and research determined outstanding professors to organize two scientific seminars within the Department of Mechanics and Equations belonging to the Faculty of Mathematics of the University of Bucharest. The first one is the Seminar of Fluid Mechanics and Applied Mathematics founded by the regretted professors Victor Vâlcovici and Caius Iacob in 1950 and the second is the Seminar of Deformable Media organized by professors Gr. C. Moisil and Nicolae Cristescu.

The topics of these seminars cover various subjects from general mechanics and mechanics of continua up to the most refined mathematical methods used in mechanics.

Within these meetings original works of high level are presented, the results of Ph.D. thesis are debated and new directions in research are studied. The results communicated are going to be published in national and international journals of prestige. Unfortunately, the publication of the papers in journals or in conference proceedings is often restricted to a limited number of pages imposing sometimes the abridgement of the text. That is why the issue of a volume series, entitled Current Topics in Continuum Mechanics, that would include original papers presented at the seminars and translated in a language of international circulation, has been necessarily imposed.

This second volume of the series, we hope to be able to sustain it financially, comprises 5 chapters arranged following the authors' alphabetical order. Further, we briefly present their contents.

i) *On a Multiplicative Schwarz Domain Decomposition Method for Variational Inequalities* – Lori Badea

A uniform convergence (provided that the convex set verifies a certain assumption) for a subspace correction method with a relaxation parameter applied to variational inequalities in a general Hilbert space is proved. This assumption holds for Schwarz's method in which the convex set is described by constraints on the function values at the points of the domain. Also, this assumption holds for the one and two-level Schwarz method in the finite element space (The constants in the error estimation depending on the domain decomposition and mesh parameters are explicitly written.). Numerical examples are given to illustrate the convergence of the method with both one and two levels, for the problem of a membrane stretched over an obstacle.

ii) *On modelling exothermic/endothermic phase transformations in shape memory alloys* – Cristian Făciu and Mihaela Mihăilescu-Suliciu

An overview of a recent one-dimensional rate-type viscoelastic model for shape memory alloys and its predictions for strain controlled problems are presented. The model is based on a rate-type thermo-viscoelastic constitutive relation. Its equilibrium stress-strain-temperature response is a non-monotone stress-strain relation for certain ranges of temperature. Each domain of convexity is identified with a phase (or variant of phase) of the material. The numerical simulations successfully capture the nucleation and evolution of transformation fronts and the corresponding temperature fields observed in laboratory experiments. The number of nucleation events and kinetics of transformation fronts were found to be sensitive to the imposed loading rate due to the release/absorbtion of latent heat. We also show that the pseudoelastic hysteresis in their strain-stress curves increases when the imposed rate is increased.

iii) *New Models of Nonlinearly Elastic Shells* – Liliana Gratie

In this work, the author identifies two new models of nonlinearly elastic shells.

In the first part, using techniques from asymptotic analysis, equations that generalize the classical Marguerre-von Karman equations are obtained. In the second part a two-dimensional nonlinear shell model of Koiter's type with variable thickness is introduced. The two-dimensional variational scaled problems for membrane and flexural nonlinearly elastic shells with variable thickness, using the displacement unknown is obtained. In addition, the specific minimization problems for these two models are written and the asymptotic treatment of the two-dimensional equations of this new Koiter's model, providing thus, its justification, is carried out.

iv) *The Regularized Diffusion in Partially Fractured Porous Media* – Dan Poliševski

An ε-periodic model of a porous medium consisting of two interwoven and connected components, with diffusivities which differ by orders of magnitude is considered here. Assuming that on the interface of these constituents the concentration has a jump proportional to the continuous diffusion flux, the author proves the convergence of the homogenization process to the so-called regularized microstructure model of diffusion.

v) *A Study of Thermal Waves in Cattaneo's Type Heat Conducting Bars* – Nicolae Simion

In this part, using the usual procedure of the Laplace transform, the author proves the existence of the *weak solutions* separated by *shock* or *acceleration waves*, for a class of initial-boundary value problems for linear hyperbolic systems encountered in Cattaneo's type thermomechanical models. *The exact solution* for the rigid bar is obtained. Some quantitative and qualitative information which can be determined using the singular surfaces theory given by Boley are also presented. The numerical method of characteristics is employed, to solve the considered problems.

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