Proceedings of the Estonian Academy of Sciences,
2008, **57**, 3, 117
Available online at www.eap.ee/proceedings

EDITORIAL

# Preface

The Institute of Cybernetics at Tallinn University of Technology and the Centre for Nonlinear Studies (CENS) have long traditions in organizing meetings on hot topics of continuum mechanics. Attention has been focused particularly on nonlinear phenomena and multiple scales. The need to understand underlying continuum physics is obvious. The previous meetings were "Nonlinear Dynamics of Heterogeneous Solids" (*Proc. Estonian Acad. Sci., Phys. Math.*, 1997, **46**/1–2), "Nonlinear Waves in Microstructured Solids" (*Proc. Estonian Acad. Sci., Phys. Math.*, 2003, **52**/1), and "Non-Equilibrium Dynamical Phenomena in Inhomogeneous Solids" (*Proc. Estonian Acad. Sci., Phys. Math.*, 2007, **56**/2). Now attention has shifted towards smaller scales.

This special issue is based on presentations made at a conference and summer school "Continuum Physics and Engineering Applications" held in Ráckeve, near Budapest, in 2007, which was co-organized by CENS, the Institute of Cybernetics at Tallinn University of Technology, and Budapest University of Technology. The aim of this event was to form a bridge over the forming gap between engineering and science. Continuum physics is nowadays developing independently in spite of the fact that it is very close to engineering practice. Some reasons for this might be that the theory is fragmented by different schools and that there seem to be unsettled disputes regarding the basic concepts (frame indifference, the role of the independent variables, etc.).

Therefore the theory is loosing ground regarding applications. Engineering practice is dominated by thumb rules, and computer programs are beginning to reign over profound thinking. On the other hand, the continuum principles are robust and universal and there are several new ideas that could be developed and applied easily (as the whole theory is close to practice), provided an organized connection with the experts of the different particular engineering fields exists. The conference and also this special issue feature contributions in different fields of continuum physics such as Extended Irreversible Thermodynamics, Nonequilibrium Thermodynamics, Mesoscopic Continuum Physics, and Numerical Methods. The subject matter of the meeting is more precisely illustrated by the following seven contributions, all of which have passed the normal refereeing procedure.

There are a contribution on Extended Irreversible Thermodynamics covering the basics and application to heat transport including thermal waves phonon hydrodynamics and saturation in the fluxes for high values of the thermodynamic forces; a contribution on objective time derivatives with the example of a fluid with a tensorial inner variable; a contribution on Mesoscopic Continuum Theory with the application to microcracks in brittle materials, where damage parameters are defined in terms of the distribution function; a contribution on thermoelasticity following new tracks by use of Onsager's thermodynamics supplemented with dynamic degrees of freedom; two contributions on numerical methods, one of them giving an overview of methods used in Continuum Mechanics and discussing the different physical meaning they induce, the other proposing a method to solve Kohn–Sham equations and to calculate electronic states, total energy and material properties of non-crystalline, non-periodic structures using finite elements'; and a review article on plant biomechanics.

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