Computer Assisted Methods in Engineering and Science, **19**: 315, 2012.

Preface

This special issue of CAMES contains eight papers, selected from 45 papers presented at the 2nd International Conference on Inverse Problems in Mechanics and Materials, called IPM 2011 for short, held in Rzeszów-Sieniawa, Poland on 27–30 April 2011. The conference continued the IPM 2009, organized in Rzeszów-Łańcut. These conferences were organized under the auspices of ECCOMAS as were the thematic conferences held in 2009 and 2011.

The papers, collected in the special issue, correspond to various problems discussed at the IPM 2011. From the view point of engineering applications the papers can be subdivided into the following engineering problems: 1) detection and classification of damage in aluminum and composite strips; 2) structural damage of a 3D steel frame; 3) load carrying capacity of reinforced concrete columns; 4) residual stress fields reconstruction in rails; 5) parameter identification of electro-phonon coupling in a thin metal film, as well as heat conduction and solidification problems.

A deeper insight into novelties of the analyzed problems gives applied laboratory testing methods and the computational analysis of testing results. This is a key for arranging the papers collected in this issue in a classified order. In the first five papers intelligent computational methods (neural networks, Bayesian methods, fuzzy sets, swarm intelligence algorithms) were discussed. In the papers by Nazarko and Ziemiański; Słoński; Jakubek non-destructive measurement methods were used in laboratory tests. These papers are based on measurements related to either guided waves and time series or on displacement measurements for the stable equilibrium paths. In the paper by Feklistova and Hein, a modal analysis was carried out. The parameter identification analysis corresponded to the neural network approach, in which Haar wavelets and support vector machines were applied for the analysis of composite strip delamination. Intelligent methods related to bee or ant colonies algorithms were applied by Hetmaniok, Słota and Zielonka to the identification analysis of heat conduction problem, in which the reconstruction of temperature distribution for a given domain was analyzed.

The results of a destructive testing method of 3D rail slices were analyzed by Magiera. He developed a refined, physically based optimization method for the reconstruction of 3D residual stress fields in rails.

In two last papers the mathematical physics equations were joined with numerical parametric identification. Special attention is worth focusing on the paper by Majchrzak and Dziatkiewicz, in which the identification of electron gas and lattice temperature coupling factor in thin metallic film was carried out. The Stefan model and computational methods were explored in the paper by Hetmaniok and Słota for the parametric identification of heat transfer coefficients in solidification of a binary alloy.

Zenon Waszczyszyn
Guest Editor