

## Preface

This Special Issue contains papers related to the Special Sessions on Artificial Neural Networks (ANNs) in Civil Engineering, organized at the 57th Annual Conference on Scientific Problems of Civil Engineering (CE). The conference called for short *Krynica 2011* was organized by the Rzeszów University of Technology under the auspices of the Committee of Civil Engineering of the Polish Academy of Sciences and the Polish Association of Civil Engineers and Technicians.

This issue, split into two parts, reflects research, teaching and promotion activities of an informal Research Group of ANNs applications in CE (RGANN). This group started at the Institute of Computer Methods in CE of the Cracow University of Technology in 1997 under supervision of Prof. Z. Waszczyszyn. Now these activities are being continued at the Department of Structural Mechanics of the Rzeszów University of Technology. The RGANN and the accompanied Standing Seminar (SemANN) have attracted young researchers, lecturers and PhD students from seven technical universities of southern Poland. Because of their enthusiasm, RGANN and SemANNs are not only a forum for presentation and discussion of new results but they have quickly developed as a centre of organization of research teams and various forms of cooperation.

The above mentioned activities of RGANN in ten years (1996–2005) were reported by Waszczyszyn in the state-of-the-art paper, published in *CAMES* **13**(4), 2006. The present Special Issue is devoted to reporting the RGANN activities after 2005. In this Special Issue a continuation of activities originated earlier is in short discussed but research projects carried out in the last six years (2006–2011) are emphasized.

The attention has been focused on development of hybrid computational systems in which advantages of ANNs to the analysis of reverse problems have been explored. Then a great deal of attention has been paid to the development of new architectures and learning methods of ANNs. A special attention has been focused on joining of the Bayesian inference and Bayesian methods with the standard ANNs. It was numerically proved that different types of ANNs turned out to be numerically efficient in various engineering applications. This concerns the problems of structural dynamics, parametric identification in concrete and R/C structures, reliability analysis of steel structures and updating the FEM models to have tools for prediction of material parameters and damage in structural elements. Worth mentioning are applications of different ANNs in the fields of geotechnics and soil mechanics as well as in geodesy. Research on joining ANNs with the measurements on laboratory models or real structures seems to be very promising from the viewpoint of searching for new non-destructive methods to predict faults of structures and damage in structural elements.

Scientific dissertations (two Polish “habilitations” and eight Ph.D. Theses were defended after 2005) are worth mentioning from among different activities. Participation and organization of two international conferences on inverse problems of mechanics and mini-symposia at international scientific conferences and congresses are worth emphasizing as a good promotion of the RGANN scientific achievements.

**Leon Ziemiański**  
**Chairman of Krynica 2011 CE Conference**

## Editorial

The Special Issue II contains eight papers. The first paper of the state-of-the-art character deals with various applications of ANNs in geomechanics, and especially, in soil mechanics. Three supplementary survey papers are devoted to the granular soils identification problems. A hybrid system of high degree of components interaction is discussed as a new approach for identification of an equivalent neural material model. The identification of soil compact characteristics and parametric identification of soil in a deep excavation are then analyzed. Four papers concern mechanics of concrete, R/C column buckling and repair of concrete industrial floors. The application of various non-standard ANN models and algorithms (Bayesian methods, Gaussian Processes, Kalman Filtering and Fuzzy Weight AN) are worth mentioning.

**Zenon Waszczyszyn**  
**Guest Editor**