CAMES, **27**(2–3): 89–91, 2020

Preface

This issue of CAMES is dedicated to the memory of Professor Witold Gutkowski in recognition of his vision, leadership, and contributions to the field of Structural Optimization. The contents of this special issue comprise a biography of Professor Gutkowski and six research papers presented during the Workshop on Engineering Optimization (WEO-2019). The Workshop was held at the Institute of Fundamental Technological Research of the Polish Academy of Sciences (IPPT PAN) on November 4th, 2019, and gathered 30 participants from five European countries. The papers address a variety of applications and cover a breadth of topics ranging from theory to computational methods.

Engineering Optimization is a multidisciplinary research area applied in such fields as: mechanical, aeronautical, electrical and civil engineering. In particular, since its beginning in the nineteenth century and the pioneering works by Maxwell and Michell, significant progress in structural optimization has been made. Initially in the field of structural optimization researchers worked on size and shape optimization problems. Currently, their efforts are oriented towards topology optimization under deterministic or probabilistic forces with multiple load conditions and the designs based on linearly elastic or elastoplastic materials.

Despite its long history, engineering optimization is still an active research area attracting new generations of scientists and engineers. From the mathematical point of view we can distinguish several different types of formulations used to solve various engineering problems. Classification can be carried out in terms of the number of objectives (single objective or multiple objectives), number of constraints, function forms (linear or nonlinear), landscape of the objective function (convex or multimodal), type of design variables (discrete, continuous or mixed), uncertainty in values and computational effort.

Regarding optimization algorithms, in general, they can be divided into two categories: deterministic and stochastic. Deterministic algorithms follow a rigorous procedure and depending on the preselected parameters they always tend to the same optimal solution. On the other hand, stochastic algorithms always exhibit a certain level of randomness, which causes the obtained optimal solution to possibly differ from one realization to another.

During the Workshop on Engineering Optimization (WEO-2019) a number of issues related to the above-mentioned methods and formulations have been presented, since there is no single optimization method suitable for all engineering problems.

The issue begins with a short biographical note on Professor Gutkowski. The paper by Błachowski and Hołobut [1] recalls major achievements of Professor Gutkowski in the field of engineering optimization and in particular his simple and efficient method for discrete structural optimization. In the Authors' opinion, Professor Gutkowski is without any doubt one of the pioneers of this research area in Poland.

The milestones of development in structural optimization since its beginning in the 19th century are described in the paper by Lógó and Ismail [2]. Starting from the pioneering works by Maxwell and Michell, the Reader is guided through the most important achievements contributed by Prager, Rozvany, Mróz and other influential researchers in the field.

Next, the paper co-authored by Graczykowski and Lewiński [3] gives excellent examples of application of Michell's Theory in structural engineering. The Authors provide a detailed discussion of conceptual design of skyscrapers as proposed by the Polish architect W. Zalewski and the international architectural office Skidmore, Owings and Merill, and of large-scale roof coverings of the "Spodek" arena located in southern Poland.

The paper authored by Zawidzki [4] moves towards computational methods in engineering optimization and describes the computational effort related to the design of the so-called Extremely Modular System. He presents a comparison of several different methods including backtracking, graph-theoretic algorithms and evolutionary algorithms.

The paper authored by Grzywiński [5] proposes a metaheuristic algorithm for solving the minimum weight problem of truss structures. Effectiveness of the so-called Jaya Algorithm is demonstrated using two benchmark examples: a planar 18-bar truss and a spatial 39-bar truss.

The paper by Bołbotowski *et al.* [6] recalls the main mathematical results concerning the theory of Michell structures. To find an optimal structure within an L-shaped domain, a problem frequently used as a benchmark in stress-constrained topology optimization, the Authors employ the ground structure approach. Additionally, they analyse two positions of the point load and a sequence of its directions ranging from 0 to π.

The special issue concludes with a paper co-authored by Lógó and Vásárhelyi [7] from the Budapest University of Technology and Economics. Their paper investigates the impact of the environmental pressure and the Geological Strength Index (GSI) of a rock mass on its Poisson's ratio.

As guest editors, we sincerely hope that this focus issue contributes significantly to the state of the art of the highly active research area of engineering optimization and serves the needs of CAMES's wide community of academic and industrial researchers and practitioners.

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Acknowledgement

We would like to take this opportunity to thank the authors and the reviewers of this special issue and to extend special thanks to Professor Tadeusz Burczyński, the Co-Editor-in-Chief of CAMES, for giving us the possibility to select the contributions, nominate reviewers and collaborate with him in the management of all manuscripts.

We would also like to thank the members of the Editorial Office of CAMES – Bogusław Lempkowski and Bogna Matuszewska-Munk, for their help and professionalism.

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