

Architectural, Engineering and Information Sciences

50th
Anniversary
Pollack Mihály Faculty of Engineering and Information Technology
University of Pács, Hungary

Abstract Book

8th International PhD & DLA Symposium
29-30 October 2012

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Cover page:

Erzsébet GYÖRI

Technical Editor: Attila FÜLÖP

ISBN 978-963-7298-48-6

Published by
Pollack Mihály Faculty of Engineering and Information
Technology, University of Pécs, Hungary
2012

ARCHITECTURAL, ENGINEERING AND INFORMATION SCIENCES

EIGHTH INTERNATIONAL PHD & DLA SYMPOSIUM

ABSTRACTS BOOK

**University of Pécs
Pollack Mihály Faculty of Engineering
and Information Technology**



**Edited by
Dr. Habil. Peter IVANYI, PhD**

**October 29-30, 2012
Pécs, Hungary**

Our new achievements in structural optimization

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Index Terms: structural optimization, topology optimization

Structural optimization needs a system, where the objective function, the unknowns, the design constraints can be found. An efficient optimization technique is also important. We have made research on different optimization techniques, like particle swarm, firefly, genetic algorithm, etc. and used these techniques solving engineering problem.

Some examples are as follows:

Cellular plates consist of two cover plates and stiffeners between them. Half I-beams employed as stiffeners for fabrication purposes. The cells are very rigid, due to their high torsional rigidity. The cost function consists of material and welding costs. The unknowns of optimization are the thickness of the two cover plates, the stiffener height and the number of stiffeners in both directions. Two optimization methods have been used, the PSO, Particle swarm optimization and the IOSO, response surface methods.

The minimum volume and cost of a simply supported planar truss with N-type bracing is optimized. The lower chord of the truss is horizontal, but the symmetric upper chord parts are non-parallel and their inclination angle as well as the cross-sectional area of CHS (circular hollow section) rods are optimized. On this way we can save a lot of the used material.

We also describe the methodology used for finding an optimum solution for a welded steel heat exchanger mounted on a domestic fireplace. The heat exchanger is used to preheat the primary and secondary air necessary for burning wood logs in the fireplace. The optimization process is combined with Computational Fluid Dynamics simulation to calculate values of design variables and the aim function.

The field of topology optimization is a well-researched and advanced area, using topology optimization is still only the starting phase for a design process as almost no manufacturing constraints can be taken into account. The current article proposes a method to fully automatize the design of truss and frame structures using topology optimization, image interpretation and finally through a sizing problem.

The optimization method of a new complex structural model [laminated carbon fiber reinforced plastic (CFRP) deck plates with polystyrene foam (EPS) inner layer]. The structure was designed for both minimal cost and minimal weight taking into consideration six design constraints.

Compressed stiffened plates with various shapes of ribs a special cost analysis has been investigated. Recommendations on fatigue of welded components of the IIW are investigated for the compressed plate. The unknown is the number of stiffeners in the optimization. The trapezoidal stiffeners had the best performance.

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Efficient algorithms for optimization of objects and systems

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Index Terms: optimisation, algorithms

Efficient algorithms are needed for optimization of objects and systems, because the user would like to be sure that the optimum is global. The paper shows a very well scalable discrete firefly algorithm, developed for solving a supplier selection problem. The MS Excel solver's general reduced gradient and the evolutionary algorithm are also compared solving this problem.

The algorithm could handle virtually any number of suppliers, till the expansion of MS Excel's solution is difficult. The run times shows that the MS Excel can't solve this problem with the default settings, although using very large run times it is approximates it well. Only the evolutionary algorithm was able to solve the problem but it is even at the third run. In this case it handles the previous run's optimum as a starting point to refine the solution. But the results show that the firefly algorithm solves the problem in the fragment of the evolutionary algorithm running time.

As an example we have formulated the mathematical modelling of multiple travelling salesmen problem, solving the fixed destination multidepot multiple tour multiple travelling salesmen problem.