Post-doctoral position in structural optimization
Université Libre de Bruxelles – BATir Department

Topic: *Structural optimization assisted by metamodels for mixed variables*

Description:

Numerical optimization in civil and mechanical engineering has emerged as a powerful method to provide lightweight structures accounting for several criteria (lower cost and environmental impact, higher safety, etc.), the usual framework consisting in coupling a *simulation* (typically: a finite element analysis) to an *optimization* code. Nevertheless, the computational effort required to assess the performances of a single design can be expensive, which hinders the ability to address large-scale industrial designs. To alleviate this issue, *surrogate-based* or *metamodel-assisted optimization* techniques have been proposed to replace the high-fidelity model by an interpolation or regression model [1]. However, most surrogates (e.g. moving least squares, kriging, artificial neural networks, support vector machines) proposed in the literature focus on continuous inputs, i.e. they cannot model discrete/integer numerical values, or technological parameters like the choice of a material (e.g. steel, aluminum).

Consequently, the objective of this postdoctoral position is to investigate a domain still largely uncovered in the engineering optimization community (despite its theoretical and industrial interest), namely the ***treatment of mixed variables in surrogate-based optimization***. Preliminary research studies in surrogate-based optimization have already been done in our department [2, 3], and novel ideas have been recently proposed to tackle mixed variables through a modified moving least square method. Starting from this background and his/her previous experience, the candidate will develop an original metamodel capable of approximating response surfaces depending on mixed variables. Academic and industrial examples (truss bridges, rigid frames) will be used as benchmarks to validate the proposed approach.

Environment:

The post-doctoral position will be accomplished within the BATir (Building, Architecture & Town planning) department of the Brussels School of Engineering/École polytechnique de Bruxelles, at the Université Libre de Bruxelles (`http://batir.ulb.ac.be`). Duration of the position: 18 months, starting in March 2012.

Profile:

The applicant should hold a PhD in computational mechanics, preferably in structural optimization. Additional competences in numerical optimization, surrogate-based optimization, and structural finite elements, as well as programming skills (in MATLAB, PYTHON, C++, or any equivalent programming language) will be highly appreciated.

Contact:

Please send by email a detailed CV (with a summary of your PhD thesis and a list of publications) along with a cover letter to: Prof. Rajan FILOMENO COELHO (`rfilomen@ulb.ac.be`). The closure date for application is set to the 1st of February 2012.

References:

[1] J W Bandler, S Koziel, and K Madsen. Editorial–surrogate modeling and space mapping for engineering optimization. *Optimization and Engineering*, 9:307–310, 2008.

[2] P Breitkopf and R Filomeno Coelho, editors. *Multidisciplinary Design Optimization in Computational Mechanics*. ISTE/John Wiley & Sons, Chippenham, UK, April 2010. 1 volume, 549 pages.

[3] R Filomeno Coelho, J Lebon, and Ph Bouillard. Hierarchical stochastic metamodels based on moving least squares and polynomial chaos expansion – Application to the multiobjective reliability-based optimization of 3D truss structures. *Structural and Multidisciplinary Optimization*, 43(5):707–729, 2011.