ENGINEERING APPLICATIONS OF EVOLUTIONARY COMPUTATION

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During the last three decades, evolutionary computation (EC) has been widely used for solving complex real-world problems. These techniques are getting popular these days for engineering design and maintenance optimization as they are commonly deal with complex problems without explicit formula. The main focus of this special session would be on the EC techniques applications to engineering optimization, and maintenance.

Optimum design, maintenance and monitoring of engineering systems, such as buildings and bridges, are challenging issues and involve several geometrical and mechanical constraints. In order to find a practical solution, most engineering design problems should be formulated as discrete or mixed variable optimization problems. Furthermore, finding efficient and lower cost procedures for frequent monitoring and maintenance of the system to increase their life span is crucially important. In this context, parameter identification, model updating, and sensor placements are some of the most important monitoring optimization problems. Mining and interpretation of the response data are other major issues that need advanced computation. Stochastic nature of most engineering system (e.g. wind and earthquake loads) make the engineering analysis even more complex. While several solutions are proposed to tackle the issues mentioned above, there is still a serious need for more cost-effective approaches. Due to their complexity, the engineering and monitoring problems are difficult to solve using derivative-based and local optimization algorithm. A viable solution to cope with this limitation is to employ global optimization algorithms, such as the EC techniques. In the recent past, EC and its branches have been used in the engineering and health monitoring to solve complex problems that cannot be solved using conventional methods. The other important issue is that several aspects can be considered to optimize systems simultaneously such as topology, configuration, stiffness, and displacement. Therefore, more than one objective should usually be considered for optimizing a real-world engineering system. This is while there are usually conflicts between the considered objectives, such as weight-displacement and cost-quality. In this case, the multi-objective optimization concept offers major advantages over the traditional mathematical algorithms. More specifically, evolutionary multi-objective optimization (EMO)

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is known as a reliable way to handle these problems in the engineering domain.

This special session strives to gather the latest development of EC applications in engineering and health monitoring. On this basis, this special session include key applications of EC on different engineering disciplines such as civil engineering, mechanical engineering, electrical engineering, biomedical engineering, etc. Topics to be included are evolutionary optimization and multi-objective algorithms, as well as evolutionary (big) data mining algorithms.

Topics

- Design optimization (topology, configuration, etc)
- Simulation optimization (grey/black box problems)
- Large scale engineering systems
- Multi and many objective engineering problems
- Expensive engineering problem (limited budget)
- Surrogate-assisted systems
- Highly constrained problems
- Embedding engineering knowledge
- Robust engineering optimization
- Probabilistic design optimization
- Reliability-Based Optimization
- Bi-level engineering optimization
- Engineering (big) data mining
- Uncertain and noisy systems