2023 Workshop on AI-based Optimisation (AI-OPT 2023)

Date: 14-15 December 2023
Venue: Deakin Downtown, Melbourne, Australia

Title of the Talk

Multi-Concept Optimization: Challenges and Opportunities
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Abstract

Multi-concept optimization (MCO) is a new and powerful approach to design optimization that allows engineers and scientists to concurrently identify the best concept and the corresponding variable values to optimize certain objective(s). This is in contrast to traditional design optimization approaches, which typically involve optimizing a single concept at a time. MCO is particularly well-suited for problems where concept selection is an inherent part of design process. For example, consider the optimization of a cantilever beam with objectives to minimize weight and deflection at the free end. Instead of restricting the search to a pre-determined shape of the cross-section, one may wish to start off by considering beams with multiple different cross-sections (e.g. circular, rectangular, L-shaped, I-shaped or T-shaped cross-sections) as plausible candidate designs, each of which represents a different concept. In fact, some studies estimate that the decisions made during the early phases of design, including concept selection and preliminary design, impact up to 70% of the overall product life-cycle costs. While such problems are commonly encountered in practical domains such as engineering, transport, product design, there has been little focus on developing computationally efficient algorithms for MCO. This is a significant barrier to the adoption of MCO in practice. MCO has a number of advantages over traditional design approaches. First, it can lead to better design solutions by exploring a wider range of concepts and variable values. Second, it can be more efficient, as it can eliminate the need to independently and extensively iterate between different concepts. However, there are a number of challenges in developing computationally efficient algorithms for MCO. This talk will discuss the challenges and opportunities in developing computationally efficient algorithms for MCO. The talk will also present a number of case studies where MCO has been used to solve real-world design problems. This talk is intended for engineers, scientists, and other professionals who are interested in learning more about MCO and its potential applications.