

Challenges in multi-criteria design optimisation for complex structures: Applications from Nano to Macro-scales

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Abstract:

Multi-criteria design optimisation is well established research field (1-3). However, when it comes to complex structures at different scales analysis, it requires more advanced computational tools such as high performance computing (HPC), heuristic approaches, surface response and other helpful tools such as artificial intelligence (AI).

Unlike the mono-objective optimisation, multi-criteria optimisation's target is more to improve a Pareto domain than finding a single solution. Once the shape of the Pareto front is determined, we may include robustness around that domain.

In this keynote lecture, I should start by an overview of the complexity of the Multi-criteria optimisation and its applications. First, for a complex composite structures at multi scale analysis (4-7) then, for a coupled Nano-device based on optical fiber with crystalline and integrated resonators (8) at nanoscale and one last example will be related to 3D printing technology (9).

Multi-criteria optimisation may involve constraints related to manufacturing process, thermal analysis or selection of mixed design parameters. However, some parameters are selected from a non-continuous domain or between fixed positions (such as data position), which makes the convergence more complicated to achieve.

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