Multi-objective Robust Topology Optimization with Dynamic Weighting

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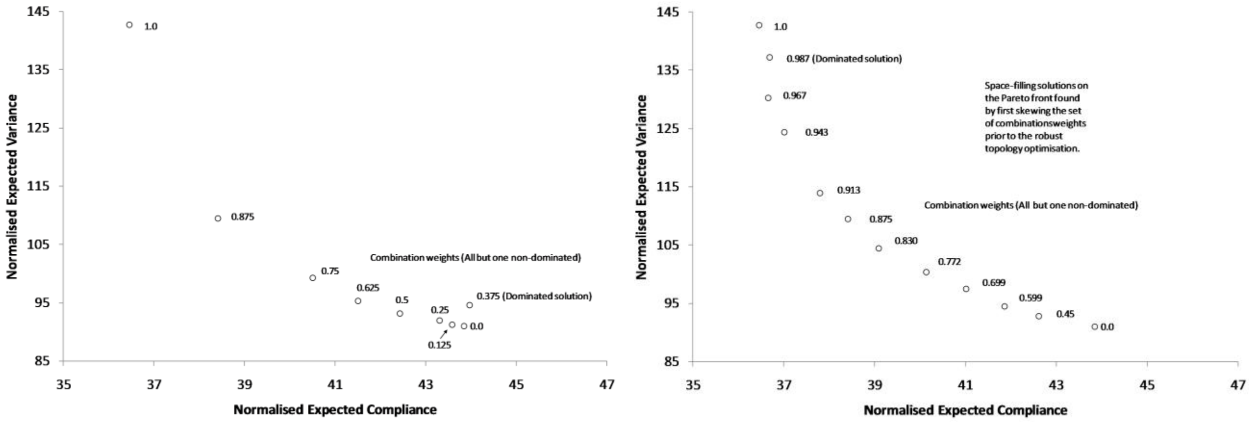
ABSTRACT

A common robust topology optimization is formulated as a weighted sum of expected and variance of the objective functions for the given uncertainties. This has recently been applied to topology optimization with uncertainties in loading, [1]. Figure 1(a) shows the Pareto front of solutions found using uniformly distributed weightings. This front suffers from crowding for weight values < 0.5 and is sparsely populated for weights > 0.625. In the general case, the two goals of multi-objective optimization are; to find the most diverse set of Pareto optimal solutions, and, to discover solutions as close as possible to the true Pareto front. This paper presents schemes to achieve both these goals.



(a) Pareto front (solutions crowded) **(b) Well-distributed solutions on the Pareto front**

Figure 1. Pareto optima of the multi-objective robust topology optimization

We present a method for determining optimal weight values for optimizations such as these and show that well distributed solutions on the Pareto front arise, as shown in figure 1(b).

Multi-objective robust topology optimization occasionally yields solutions dominated by those on the Pareto front as seen in figure 1(a) and (b) for weights of 0.375 and 0.987. We also present a dynamic weighting approach that can avoid this problem and we show that solutions can be encouraged to converge closer to the true Pareto front by manipulating the weighted sum.

References

[1] P.D. Dunning, H.A. Kim, Robust topology optimization: Minimization of expected and variance of compliance, *AIAA Journal*, online. doi: 10.2514/1.J052183.