## A Unified Framework for Model-Based Multi-objective Linear

Process and Energy Optimisation under Uncertainty

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## Abstract

Process and energy models provide an invaluable tool for design, analysis and optimisation. These models are usually based upon a number of assumptions, simplifications and approximations, thereby introducing uncertainty in the model predictions. Making model based optimal decisions under uncertainty is therefore a challenging task. This issue is further exacerbated when more than one objective is to be optimised simultaneously, resulting in a Multi-Objective Optimisation (MO<sup>2</sup>) problem. Even though, some methods have been proposed for  $MO^2$  problems under uncertainty, two separate optimisation techniques are employed; one to address the multi-objective aspect and another to take into account uncertainty. In the present work, we propose a unified optimisation framework for linear MO<sup>2</sup> problems, in which the uncertainty and the multiple objectives are modelled as varying parameters. The  $MO^2$  under uncertainty problem (MO<sup>2</sup>U<sup>2</sup>) is thus reformulated and solved as a multiparametric programming problem. The solution of the multi-parametric programming problem provides the optimal solution as a set of parametric profiles.

Keywords: Multi-objective Optimisation, Multi-parametric Programming, Optimisation under uncertainty, Energy systems.