

SURVEY ON THE USE OF COMPUTATIONAL OPTIMISATION IN UK ENGINEERING COMPANIES

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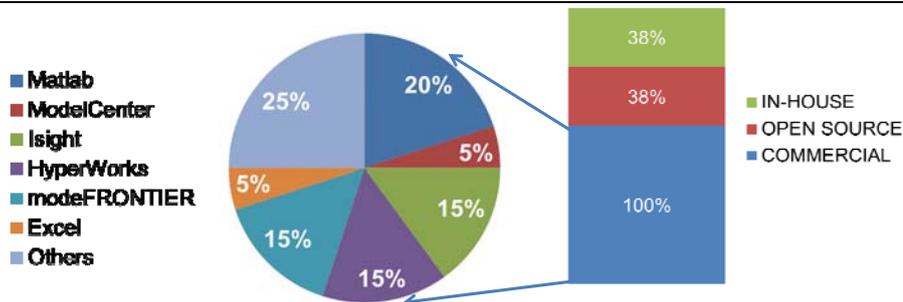
ABSTRACT

The aim of this work is to capture current practices in the use of computational optimisation in UK engineering companies and identify the current challenges and future needs of the companies. To achieve this aim, a survey was conducted from June 2013 to August 2013 with 17 experts and practitioners from power, aerospace and automotive Original Equipment Manufacturers (OEMs), steel manufacturing sector, small- and medium-sized design, manufacturing and consultancy companies, and optimisation software vendors. By focusing on practitioners in industry, this work complements current surveys in optimisation that have mainly focused on published literature.

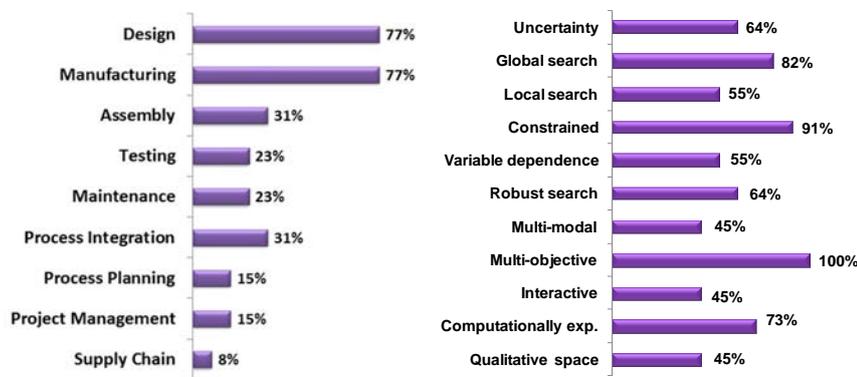
This survey was carried out using a questionnaire administered through face-to-face interviews lasting around 2 hours with each participant. The questionnaire covered 5 main topics:

1. State of optimisation in industry: This section identified how widely optimisation is used in industry, how well optimisation is integrated with the design process, and which evaluation and optimisation packages are the most popular.
2. Optimisation problems: This section identified the features of optimisation problems (such as constraints, multiple objectives and computational expense) and the domains in industry that experience these features (such as design, manufacturing and assembly).
3. Modelling techniques: This section identified the modelling techniques used in industry when dealing with optimisation problems.
4. Optimisation techniques: This section identified the optimisation techniques used in industry and their strengths and weaknesses in handling various problem features. It also captured the importance of each problem feature in terms of the effort required to deal with it.
5. Challenges faced and future research areas: This section captured the key industrial challenges in optimisation and the requirements for future research.

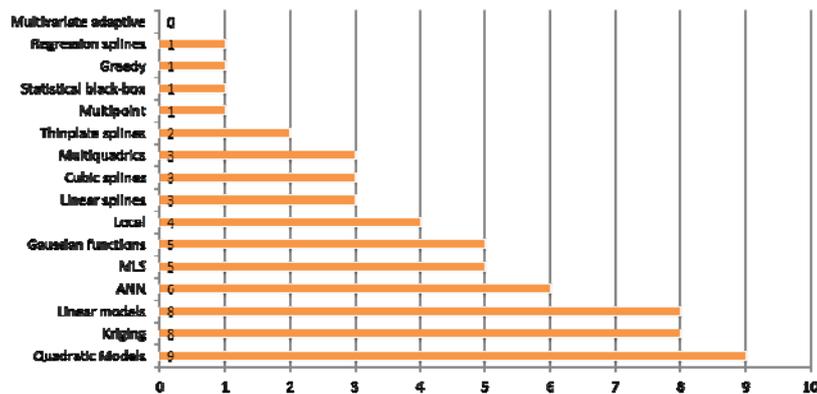
This abstract summarises the key results from this survey as presented below:



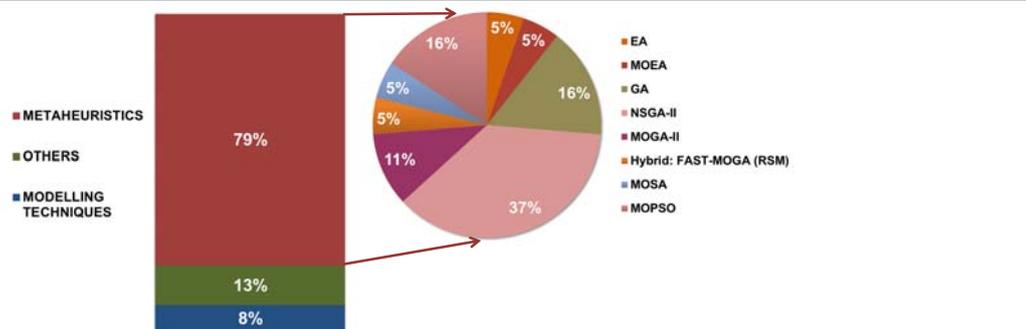
Percentage of companies using commercial, open source and in-house optimisation packages, along with a breakdown of commercial packages



Percentage of companies using optimisation in different domains and with different features



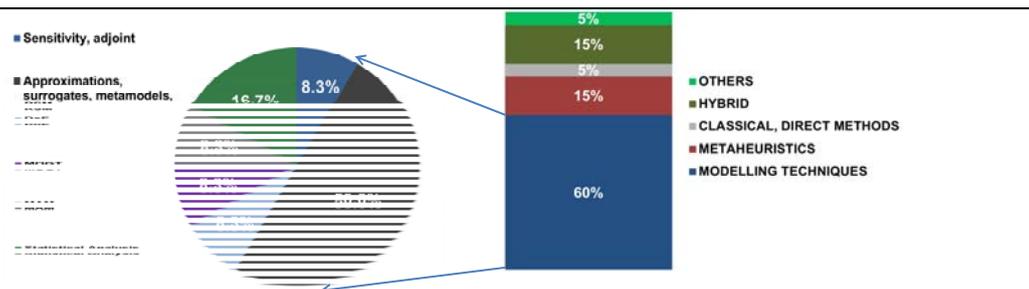
Number of companies using different techniques for approximations and surrogates



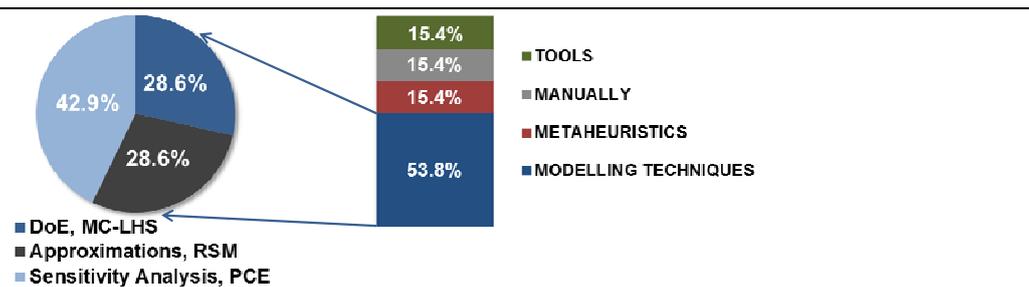
Percentage of companies using different techniques for multi-objective optimisation, along with a breakdown for metaheuristics



Percentage of companies using different techniques for handling constraints



Percentage of companies using different techniques for computationally expensive optimisation, along with a breakdown for modelling techniques



Percentage of companies using different techniques for robust search, along with a breakdown for modelling techniques

Finally, this survey identified the following challenges that the participant companies are facing in solving optimisation problems: large number of objectives and variables, availability of computing resources, data management and data mining for optimisation workflow, over-constrained problems, too many algorithms with limited help in selection, and cultural

issues including training and mindset. The key areas for future research suggested by the participant companies are as follows: handling large number of variables, objectives and constraints particularly when solution robustness is important, reducing the number of iterations and evaluations, helping the users in algorithm selection and business case for optimisation, sharing data between different disciplines for multi-disciplinary optimisation, and supporting the users in model development and post-processing through design space visualisation and data mining.

SUGGESTED THEMES

Engineering Optimisation, Industry Survey, Real-life Applications of Optimisation