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Preface

The book comprises a collection of selected papers presented at the third US United Engineering Foundation's 'Optimization in Industry' Conference. This biennial UEF event concentrates upon state-of-the-art approaches to the optimization of engineering systems/structures with an emphasis upon industrial application.

The United Engineering Foundation (UEF) comprises the American Society of Civil Engineers, the American Institute of Mining, Metallurgical and Petroleum Engineers, the American Society of Mechanical Engineers, the Institute of Electrical and Electronics Engineers and the American Institute of Chemical Engineers. UEF conferences were established in 1962 as leading edge symposia in significant areas of engineering. The more than seven hundred conferences held since then have been instrumental in generating ideas and disseminating information in greater depth than is possible through most conventional presentations or publications.

The Conference was also sponsored by the UK Engineering and Physical Science Research Council's Engineering Network in Adaptive Computation in Design and Manufacture (ACDMnet). The Network has been established to help researchers and industrial practitioners using evolutionary and adaptive computing technologies pool their knowledge and disseminate results. The aims of the Network include improved communication between academic and industrial groups, greater industrial penetration of these technologies, the establishment of best practice and the promotion of awareness within academia and industry of emerging related techniques and how they may be applied to design and manufacturing.

Optimization, as an area of academic research has been with us for around fifty years with numerical, deterministic methods being developed and tentatively introduced into industrial engineering environments with varying degrees of success in the 60s and 70s. Certain stochastic optimization processes such as Schwefel's evolution strategies grew out of the early gradient-based solution perturbation techniques whereas others, such as Holland's genetic algorithm approach, developed in parallel but relatively independently with origins in the artificial life/intelligence domain.

By the 1980s the utilisation of numerical optimization techniques had increased significantly with application to a wide range of problems and increasing integration with finite element packages. Sophisticated, graphics-based

optimization software appeared in the 1990s and continues to develop. The stochastic techniques, however, remained largely a research topic due, in part, to the computational expense associated with their integration with complex analysis. It is only over the last ten years that a major potential has been realised with significant application of stochastic optimization across an increasingly diverse set of problem domains. There is a noticeable increase in the number of companies specialising in the application of evolutionary technologies. Expertise in the technology within the larger industrial organisations is also increasing with the development of in-house evolutionary/adaptive computing groups applying the techniques to a variety of complex multi-variate problems. Application-oriented research is now addressing serious integration issues with the inclusion of stochastic search in problem-solving environments and application-specific software.

The main thrust of Optimization in Industry III is again in the field of engineering optimization including both manufacture and parametric design. The expertise of the co-chairs and organising committee reflects the intention to explore the relationships between well-established deterministic optimization methodologies and practices and the emerging stochastic and mainly population-based search and optimization algorithms. The intention was to achieve an investigation of a mix of approaches across a wide spectrum of engineering disciplines. Discussion resulted in the identification of the manner in which various techniques can be utilised either in a stand-alone manner or within hybrid systems for best performance in terms of optimal design solutions and computational efficiency. This third event took place over a five day period with a daily mixture of keynote talks, poster sessions and related workshops. A clear objective that was successfully achieved was a high degree of interaction between delegates.

Due to the nature of the meeting the book contains a mix of papers that span scientific, application, awareness/information dissemination and industrial requirement areas. All papers were first reviewed in terms of initially submitted abstracts/position papers with those accepted for presentation at the meeting before undergoing further review after being developed into full papers. The review processes considered submissions with equal weighting to each of the above aspects. The intention has been to produce a publication that reflects the overall objectives of the meeting. The main objective was to provide information to both the industrial and academic community relating to available search and optimization techniques and their utility in both specific problem areas and across design and manufacturing as a whole. The identification of problems facing industry relating to the successful integration of such techniques with day-to-day design practice and of industrial requirement in terms of the capabilities of developed/developing software also played a major role.

The reviewing process was therefore significantly different to that of a scientific journal for instance. Collectively, the papers included in the book should provide the reader with sufficient information to assess the state-of-the-art in both academe and industry and possible solutions that will play a role in ensuring the successful future integration of optimization technologies with industrial design and manufacturing processes. The discussion papers developed from the various workshops have also been included. The objective of these papers has been to

capture and summarise the main aspects of the discussive workshops held on each day of the Conference.

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