A perspective on the current status of the challenges in the computational modelling of fluids interacting with other physical phenomena

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Abstract
These days the computational modelling of fluids is increasingly accompanied by the need to include its interactions with other phenomena, such as, electromagnetic fields and structural responses. In this sense, the modelling of this class of processes is best characterised as 'multi-physics', where although CFD is at the heart of the simulation task, it is nevertheless vital to include the behaviour of other phenomena at an equivalent level of numerical and physical sophistication. The problems here are twofold - one is concerned with the formulation and representation of the interactions in a manner that enables a computational solution, whilst the second is focussed upon the challenges of implementing appropriate solution strategies and delivering simulation results. A significant part of this problem arises from the fact that the historical development of computational solution procedures and supporting software technologies has taken different routes for each of the main phenomena. Since the modelling of closely coupled physical phenomena requires time and space accurate simulations of all aspects of the calculation, then new kinds of software technologies are required to facilitate this activity. This lecture will address this isue in detail and explore the practical ways forward.

Biog - Professor Mark Cross

Mark Cross is Professor of Computational Modelling and Director of the Centre for Numerical Modelling and Process Analysis at the University of Greenwich where he has worked for over 20 years. He has a BSc in Mathematics, a PhD in Mathematical Physics and a DSc in Computational Engineering. He has authored over 300 publications and supervised over 40 PhD students. The editor of the Elsevier archival journal, Applied Mathematical Modelling since 1984, he also has an equity stake in three technology start-up companies. He has consulted for a wide range of multi-national technology organisations over the last 20 years or so, including the US Army, NASA, Rio Tinto, Rolls Royce and US Steel. His abiding research interests cover all aspects of computational modelling, from numerical methods through the exploitation parallel systems to strategies and software for the analysis of multi-physics and multi-scale problems.