Project title: Analytical and computational methods for the efficient and reliable approximation of complex, high-dimensional systems

Summary: We shall investigate simple methods for approximating complex systems with functions and networks and analyse them for efficiency and reliability based on the size of the input/available data. Under efficiency, we understand the amount of work required to compute the approximating function in dependence of the size of the data and under reliability the derivation of error estimates which qualitatively describe the applied approximation methodology.

Description and motivation: We consider abstract formulations of systems for which we do not know in detail its internal structure. Examples include commercial software in computational finance such as option pricing/general trading, where the underlying model/code is hidden from the customer, flows through natural porous media and reservoirs, or traffic networks of large cities such as London, Los Angeles, Mexico, etc.. The control (e.g. based on information obtained from software or of traffic flow via mobile navigators) requires a systematic and reliable computational framework for capturing/storing relevant information contained in data such as input/output streams (software), location and time of traffic jams (cities), or pressure/material flux in porous media. In this project we will develop the fundamental mathematical tools for such a computational framework.

PhD Candidate: We are looking for a PhD candidate in Mathematics (Applied) and Mathematical Physics or any other equivalent field such as electrical engineering/signal analysis. The student should be enthusiastic for learning and understanding new concepts and preferably have a fundamental understanding in one of the following fields: finite element methods, wavelets, or graph theory.

If you are interested, please pass on your CV and a transcript of marks to Markus Schmuck (**M.Schmuck@hw.ac.uk**), see also **Personal Web** & **James Watt Scholarships**. The successful candidate will be based at the Maxwell Institute at Heriot-Watt but will closely collaborate with teams at University of Edinburgh and Imperial College London. The successful candidate is also expected to present results at premier conferences in fluid dynamics like the American Physical Society - Division of Fluid Dynamics and British Applied Mathematical Colloqium and publish in premier journals such as Journal of Fluid Mechanics.