Title: Advanced numerical simulation techniques for industrial CFD applications

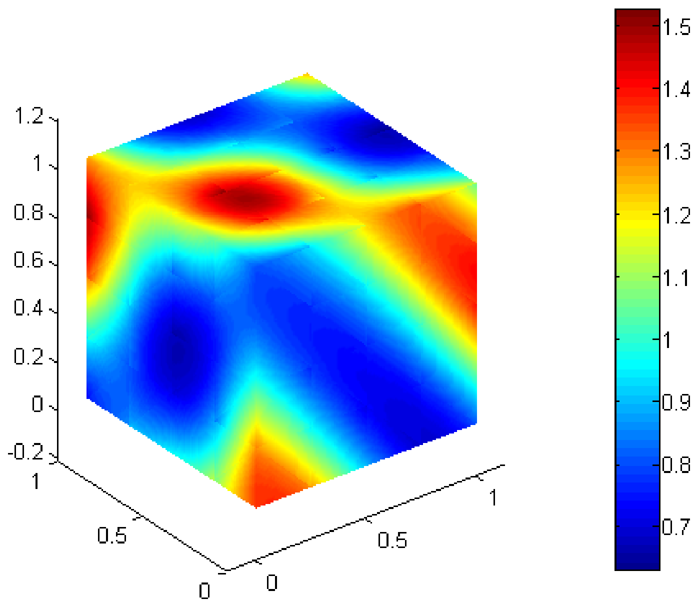
M. Saqib Hameed

Supervisors: Prof. Antonio Huerta, Dr. Ruben Sevilla

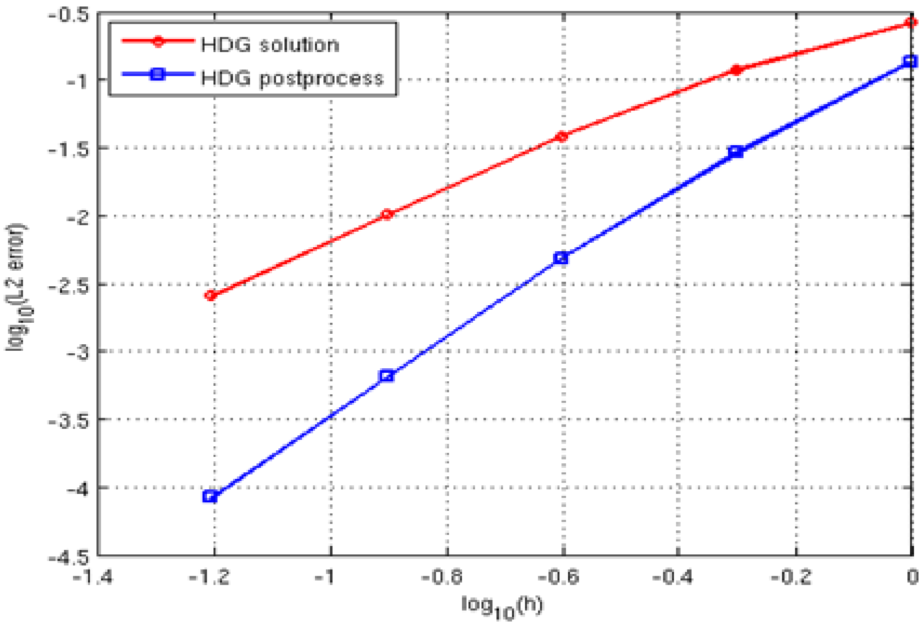
UPC, BarcelonaTECH, Swansea University, UK

The higher order CFD methodologies developed in academia have not yet been very useful and consistent for many industrial problems where high accuracy and lower computational costs are required. This is the reason why these methods have received a considerable dedication of resources and attraction of researchers in the past decade. There is a need to develop and combine the high-order accurate time and space discretization methods in order to tackle the CFD problems of industrial relevance and replace the low-order methods which are already being used.

This project will further develop and combine the higher-order methods particularly of CFD industry and compare with techniques with already existing lower-order industrial techniques. It aims to accurately and efficiently simulate the turbulent compressible flows using p-hybrid HDG method and high-order time marching algorithms. Geometric uncertainties may compromise the efficiency of a standard p-adaptive algorithm in the presence of curved boundaries. This project will remove the geometric uncertainty by combining the technique (HDG) with NURBS-Enhanced Finite Element Method (NEFEM) which will be further extended to boundary layer and non simplicial elements.



Solution of Poisson equation (primal variable) in a 3D domain



Convergence of solution for 3D Poisson problem, before (k+1) & after (k+2) post-processing