6th European Conference on Computational Mechanics (ECCM 6)
7th European Conference on Computational Fluid Dynamics (ECFD 7)
11-15 June 2018, Glasgow, UK

TOWARDS A REDUCED ORDER MODELLING APPROACH FOR COUPLED ACOUSTO-MAGNETO-MECHANICAL PROBLEMS WITH APPLICATION TO MRI SCANNERS

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Keywords: *Medical imaging, MRI, Model order reduction, PGD, Multi physics.*

The design phase of a new magnetic resonance imaging (MRI) scanner can take up to three years. From the computational standpoint, this can involve repetitive simulations for varying frequency loading conditions, material parameters and geometrical configurations. Therefore, it seems sensible to consider the use of a reduced order model (ROM) approach, in this case the proper generalised decomposition (PGD) [1]. This *a priori* ROM method typically computes, in an off-line stage, a generalised parametric solution considering loading/material/geometric parameters as extra coordinates. Subsequently, fast and real-time (on line stage) computations can be achieved by the end-user (designer) for a given specific subset of the parametric space.

The classical (non-ROM based) computational approach that describes the behaviour of an MRI scanner requires the simulation of an acousto-magneto-mechanical problem which can be approximated via a linearised axisymmetric formulation [2]. Despite its accuracy, this strategy can be computationally very expensive for large parameter sweeps. To overcome this, we will consider the frequency as the parameter of interest in the on-line stage in order to quickly sweep over a range of frequencies to analyse the response of the MRI system. In the presentation, we will show that, through the application of PGD, we are able to drastically reduce the computational cost whilst maintaining the same level of accuracy as in the classical approach.

This project is part of the Marie Skłodowska-Curie ITN-ETN AdMoRe funded by the European Union Horizon 2020 research and innovation program with grant number 675919.

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