11th World Congress on Computational Mechanics (WCCM XI)
5th European Conference on Computational Mechanics (ECCM V)
6th European Conference on Computational Fluid Dynamics (ECFD VI)
July 20–25, 2014, Barcelona, Spain

COMPUTATION OF ELECTROMAGNETIC CAVITY MODES USING THE DISCONTINUOUS GALERKIN TIME-DOMAIN METHOD

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Key words: *Discontinuous Galerkin Time-Domain, high-order, Maxwell's equations, cavity modes.*

Optical and photonic resonators have found a great variety of applications in the design of systems and devices such as lasers, filters, switches and sensors. The main motivating factor for advancing this technology is the quest to miniaturise many optical and photonic systems and components.

Time domain solvers are well suited for applications in optics and photonics due to their ability to provide broadband frequency response. They also employ substantially less memory than frequency domain solvers, making possible the study of ever more complex devices. Among all the available approaches, the finite difference time domain method [1] forms the basis of the majority of the existing commercial software. However, this method faces major difficulties when attempting to solve problems involving complex geometries, due to the use of structured grids. Other, well established, time domain techniques are the transmission line method and the finite element method. However, there are also issues associated with these techniques [2], such as the dissipation and/or dispersion errors inherent to low-order approximations.

This talk will focus on the use of the high-order discontinuous Galerkin time-domain (DGTD) method for the computation of electromagnetic cavity modes. Standard signal processing strategies, such as the discrete Fourier transform, and more advanced approaches, such as the filter diagonalisation method, will be combined with the DGTD method to obtain the eigenspectrum. The advantages of the proposed methodology will be discussed and a simple strategy to improve the performance of the DG method by using specially designed hybrid meshes will be presented [3].

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