

## STS-09

# FreeFEM – the Open Source Multiphysics Toolbox (Part 1)

Chairs: Frédéric Hecht<sup>1</sup> and Frédéric Nataf<sup>2</sup>

Sorbonne Univ., Laboratory J. L. Lions and INRIA Team Alpines, Paris, France

<sup>1</sup> [frederic.hecht@sorbonne-universite.fr](mailto:frederic.hecht@sorbonne-universite.fr)

<sup>2</sup> [frederic.nataf@sorbonne-universite.fr](mailto:frederic.nataf@sorbonne-universite.fr)

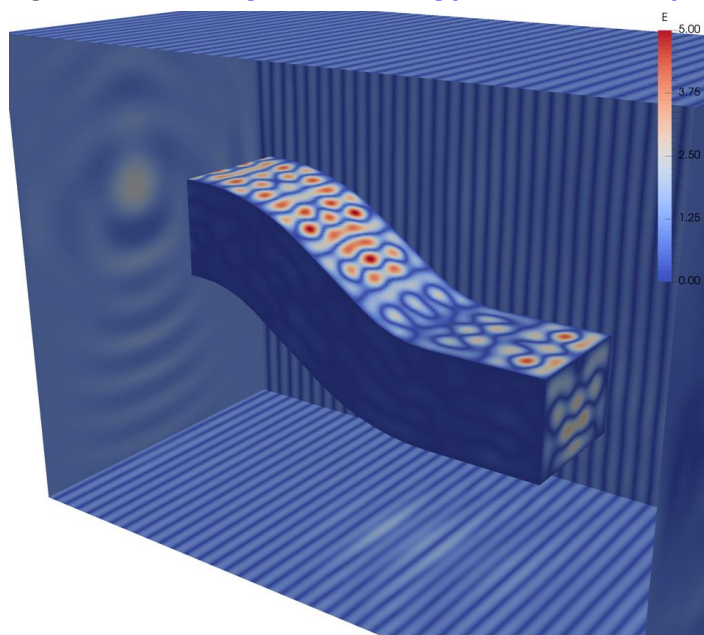
### Session Abstract

**Keywords:** *Multiphysics, domain specific language, FreeFEM*

FreeFEM is a popular 2D and 3D partial differential equations (PDE) solver used by thousands of researchers across the world and by many companies. It allows you to easily implement your own physics modules using the provided FreeFEM language. Numerous physics are pre-built: Incompressible Navier-Stokes (using the P1-P2 Taylor Hood element), Lamé equations (linear elasticity), Neo-Hookean, Mooney-Rivlin (nonlinear elasticity), Thermal diffusion, Thermal convection, Thermal radiation, Magnetostatics, Electrostatics, Fluid-structure interaction (FSI), ... . FreeFEM has its own internal mesher, called BAMG, and is compatible with the best open-source mesh and visualization software like Tetgen, Gmsh, Mmg and ParaView. It is interfaced with the state of the art solvers: MUMPS, PETSc, PARADISO and HPDDM. FreeFem is also a language for the manipulation of data on multiple meshes. It allows rapid multiphysics prototyping and can be viewed as a kind of MATLAB for the finite element method. This software is based on an efficient DSL (Domain Specific Language) user language that allows you to define freely your simulation and the post processing analysis.

The papers of this STS will present industrial achievements of Multiphysics modeling using FreeFEM (fluid structure interaction, piezoelectric, thermodynamic energy storage, thermic analysis, glass modelling) as well as its availability on an energy efficient server platform.

**Figure 1:** *Electromagnetic scattering from COBRA cavity*



**List of session papers and speakers (Part 1):**

**Free FEM – The Open Source Multiphysics Toolbox (*An introduction into the sessions*)**

Frédéric Hecht and Frédéric Nataf, Sorbonne Univ., Paris, France

**Finite Element Solution of a Solder Filing Problem with Contact Angle and Volume Constraint**

Atsushi Suzuki, Cybermedia Center, Osaka University, Japan,

[atsushi.suzuki@cas.cmc.osaka-u.ac.jp](mailto:atsushi.suzuki@cas.cmc.osaka-u.ac.jp)

Hiroshi Ogawa, DENSO Corporation, Japan

**Gob Forming: an Example of FreeFEM Use in Glass Industry**

Gérard Maes, ARC, Departm. Furnace Engineering, R&D Modelling and Simulation

**Thermal Modelling of Injection Moulding of a PET Preform**

Marc Youcef, Husky Injection Molding Systems, Luxembourg

**Surface Acoustic Waves Transducer Analysis with a Conventional P-Matrix Model Derived from Periodic FEM-BEM Using FreeFEM++**

Pascal Ventura, Université de Lorraine, Nancy, France, [pascal.ventura@univ-lorraine.fr](mailto:pascal.ventura@univ-lorraine.fr)

Pierre Dufilié, Phonon Corporation, East Granby CT, USA

Frédéric Hecht, LJLL Sorbonne Université, Paris, France