

ELECTROMAGNETICS SIMULATION TOOL

*fluidyn*TM – **MP EMG** is software tool for electromagnetics applications. It consists of four sub-modules, that solve the Maxwell equations in different forms, designed for specific applications:

1. **MHD**: Magneto-hydrodynamics
2. **ELFE**: Electric systems under static or low frequency electromagnetic fields
3. **FVTD**: Transient high frequency electromagnetics
4. **EBFC**: Electrochemistry.

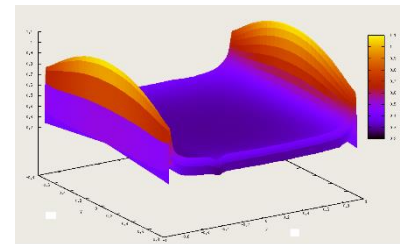
These modules can be activated in a coupled manner either with other modules of the same family or with the CFD/FSI/CHT modules of *fluidyn*TM – **MP** software platform in the same multiphysics simulation.

The *fluidyn*TM – **MP EMG-MHD** module simulates Magneto-Hydrodynamics (MHD) flows. Its main features are:

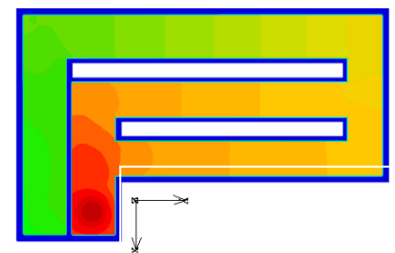
- magnetic induction method and electric potential method.
- robust and accurate schemes for modelling flows at very high Hartmann numbers
- electromagnetic fields in both solid and fluid regions computed simultaneously.
- Joule heating effect
- Fringing magnetic fields

EMG-MHD can be used in applications such as:

- MHD flow of electrically conducting fluids
- Continuous casting
- Magnetic drug targeting
- Electromagnetic pumps (under coupling with **EMG-ELFE**)



Flow velocity at sudden expansion

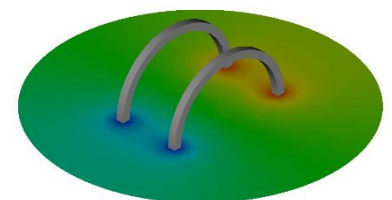


*fluidyn*TM – **MP EMG-ELFE** module computes the electric field in electrical circuits and components. Its main features are:

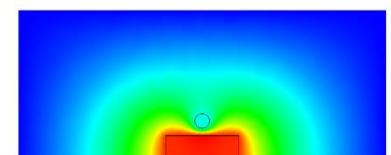
- solves magnetic vector potential. Other electromagnetic parameters - flux density, induced emf, electric field intensity, current, etc. - computed using Maxwell's equations.
- mechanical parameters of relevance such as force, torque, etc.
- Static or low frequency electromagnetic fields

EMG-ELFE can be used in applications such as:

- Capacitors, resistors, motors, coils, magnets, sensors and actuators
- Electrical and thermal analysis of PCBs (under coupling with **MP-CFD**)



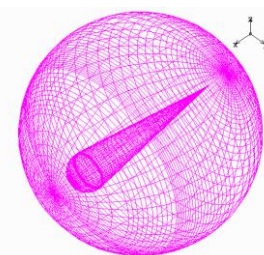
Helmholtz Coil



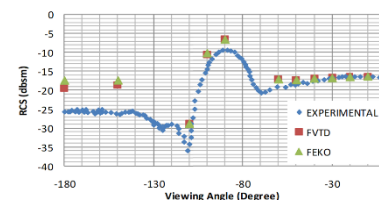
Induction Heating

fluidyn™ – MP EMG-FVTD is a Finite Volume Time Domain (FVTD) solver to analyse the electromagnetic scattering from complex 3-D objects. The FVTD solver; solves the Maxwell's equations for the scattered field numerically. It provides the scattered fields throughout the computational domain, which is normally a region close to the scatterer such as Radar Cross Section (RCS). Its main features are:

- Highly accurate FVTD solver; uses 3rd order accurate numerical schemes
- Supports unstructured mesh
- Incident field in the form of harmonic and Gaussian pulse
- PEC, RBC and PML boundary conditions
- Performs VV and HH simulations



Cone-sphere with gap

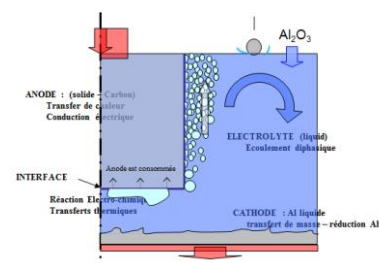


Its applications include:

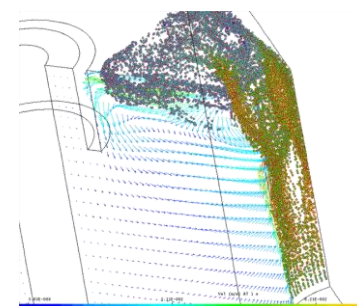
- Generates complex electric and magnetic field data
- RCS prediction of aircrafts, ships, drones, tanks, etc.

fluidyn™ – MP EMG-EBFC can analyse multiphase flow, heat transfer, chemistry, and electro kinetics in electrolysis cells such as chlorate cells, batteries, and fuel-cells. The software consists of a Finite-Volume CFD solver for simulating electrolysis. Its main features are:

- Electrochemistry
 - Electrode and electrolytic reactions
 - 2-phase and solid electrolytes
 - Bubble generation, transport, coalescence
 - Potential jump at electrodes
- Ion transport
 - Convection, diffusion, migration
 - Electrophoresis



Aluminium cell



Bubble plume in electrolysis cell

Its applications include:

- Electrolysis, chlorate, aluminium cells
- Fuel cells
- Batteries

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