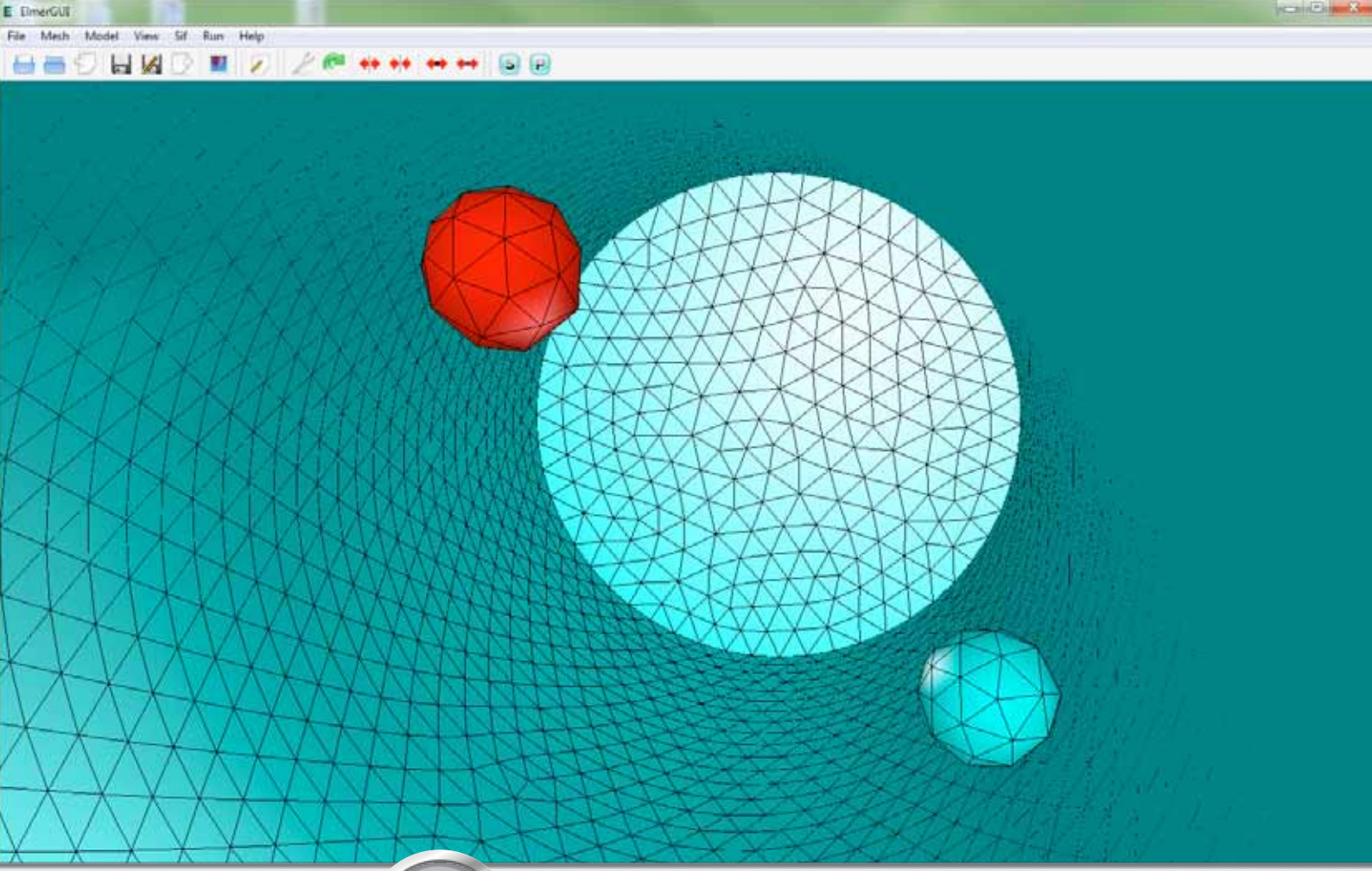


APPLICATION SERVICES

ELMER A FINITE ELEMENT MULTI-PHYSICS PACKAGE

ELMER IS AN OPEN SOURCE MULTI-PHYSICS SIMULATION SOFTWARE DEVELOPED BY CSC. IT IS CAPABLE OF SOLVING PHYSICAL MODELS OF FLUID DYNAMICS, STRUCTURAL MECHANICS, ELECTROMAGNETICS, HEAT TRANSFER AND ACOUSTICS, FOR EXAMPLE.

SOFTWARE PACKAGE

The models are described by partial differential equations which Elmer solves by the Finite Element Method (FEM). Elmer is intended for education, academic research, and R&D projects, where computational efficiency and flexibility play a key role.

The source code of Elmer is based on modern finite element technologies and numerical methods. It is written in Fortran90,C, and C++, and distributed under the GNU Public Licence (GPL).

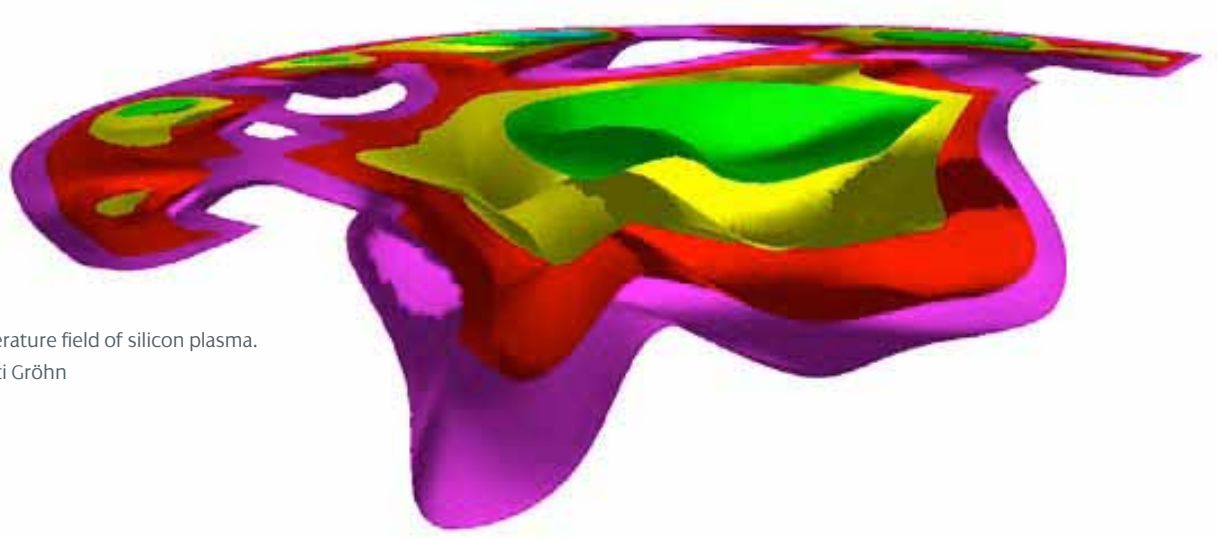
ElmerSolver is the core of the software package. It processes partial differential equations in a discrete form, handles coupled systems, nonlinearities and time-dependencies, and generates output data for post processing and visualization.

ElmerSolver provides

- Basic data structures for generic finite element computations
- Element libraries (including p-elements) and quadratures
- Iterative solution methods for linear algebraic systems
- Parallel solution based on domain decomposition
- Residual based error indicators and adaptive mesh refinement
- Geometric multigrid for large scale problems
- Solvers for algebraic eigenvalue problems
- Boundary element methods.

From applications' point of view, ElmerSolver provides methods for solving

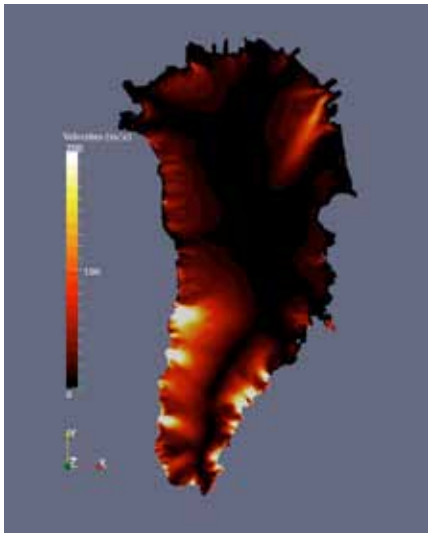
- Physical problems involving diffusion, convection and reaction
- Incompressible and compressible Navier-Stokes equations
- Non-linear and linearized elasticity with (an)isotropic materials
- Helmholtz and Schrödinger equations
- Electromagnetics, including electrostatics and magnetic induction
- Lagrangian and Eulerian free surfaces methods
- Particle tracker with bidirectional coupling to FE fields
- Strategies for coupled problems, such as Fluid-Structure Interaction (FSI) and magnetohydrodynamics (MHD).



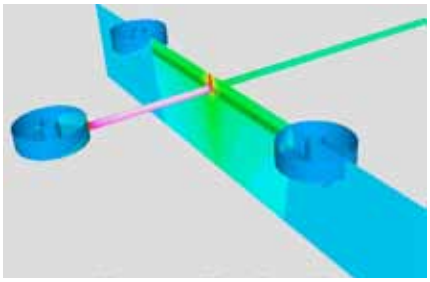
Temperature field of silicon plasma.
© Matti Gröhn

ElmerSolver has a modular architechture, which makes it easy to extend and maintain. The parallel version of ElmerSolver is based on the Message Passing Interface (MPI) library.

ElmerGUI is the graphical user interface for defining and generating the input data for ElmerSolver. ElmerGUI is capable of creating 2D and 3D Delaunay partitionings and importing external meshes produced by other software. The module is intended for fast prototyping, testing, and educational purposes.



The surface velocities on the Greenland ice sheet obtained with CSC multi-physics package Elmer for the Searise experiment 1.
© 2010 Hakime Seddik, ILTS, Hokkaido University, Sapporo, Japan.



Temperature of substrate in microfluidistic component. © Thomas Zwinger

ElmerPost is the visualization and post processing tool for the numerical results produced by ElmerSolver, and also by other finite element programs. ElmerPost is capable of drawing contours, iso-surfaces, vector fields, and can manipulate data using the built-in MATC-language (for instance compute gradients of scalar fields and divergences of vector fields).

ElmerGrid is a meshing tool that can create simple structured 1D, 2D and 3D meshes of first, second and third order. The program can be used as a filter and converter for exporting, manipulating and transforming finite element meshes and file formats.

IN DEPTH SUPPORT

For questions concerning the basic use and capabilities of Elmer, our "discussion forum" with the user community provide help and support. Contracted, individual support and collaboration opportunities is offered to our customers by our developers.

Velocity field of blood flow in aorta.
Copyright Esko Järvinen.

INFO

FURTHER INFORMATION

www.csc.fi/elmer

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Elmer

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