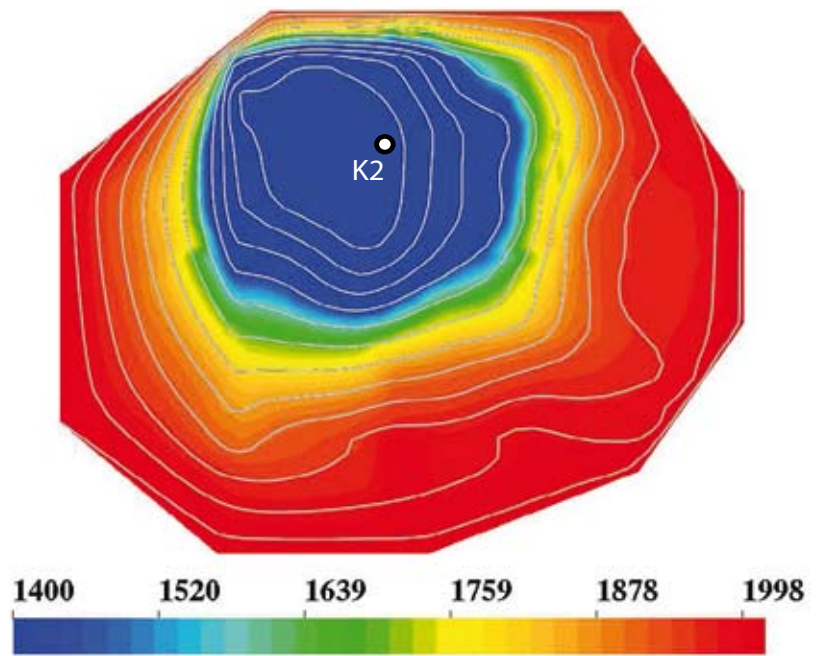
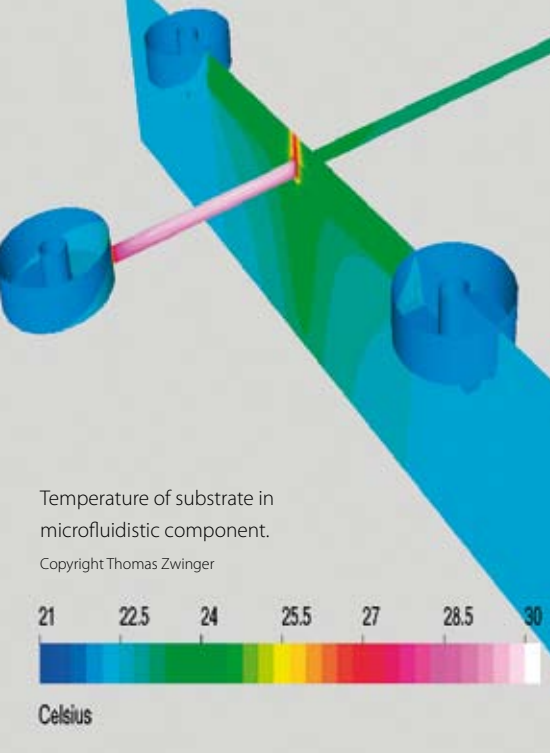


APPLICATION SERVICES



 Elmer a Finite Element multi-physics package



Age of ice in Gorskov crater. Copyright Thomas Zwinger

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. 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.

Software package

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).

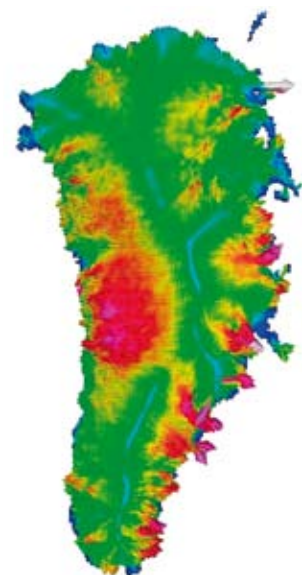
ElmerSolver is the core of the software package. It processes partial differential equations in a discrete form, handles coupled systems, non-linearities and time-dependencies, and generates output data for post processing and visualization. ElmerSolver provides

- 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
- Special strategies for coupled problems, such as Fluid-Structure Interaction (FSI) with Arbitrary Lagrangian-Eulerian (ALE) formulation, and magnetohydrodynamics (MHD)

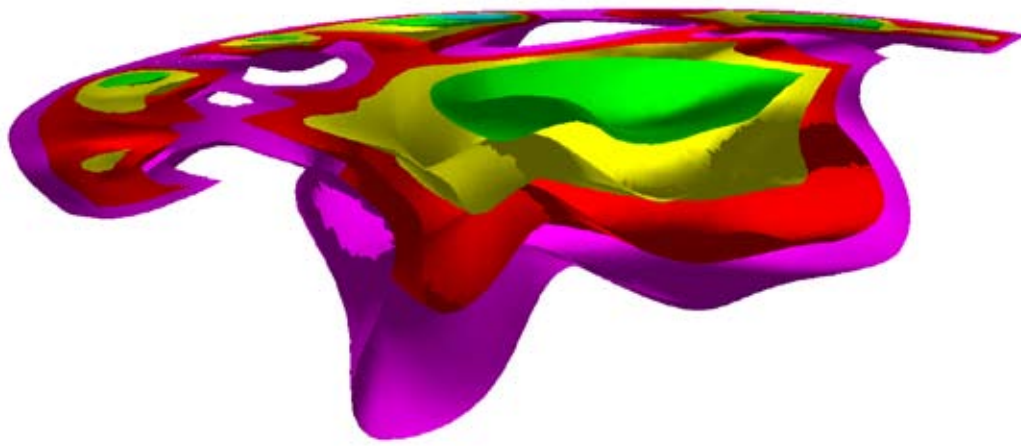
ElmerSolver has a modular architecture, which makes it easy to extend and maintain. The parallel version of ElmerSolver is based on the Message Passing Interface (MPI) library.



Preliminary simulation of the Greenland ice sheet.

Copyright Data: Prof. Ralf Greve (ILTS, Hokkaido University, Japan)

Visualization: Thomas Zwinger



Temperature field of silicon plasma. Copyright Matti Gröhn

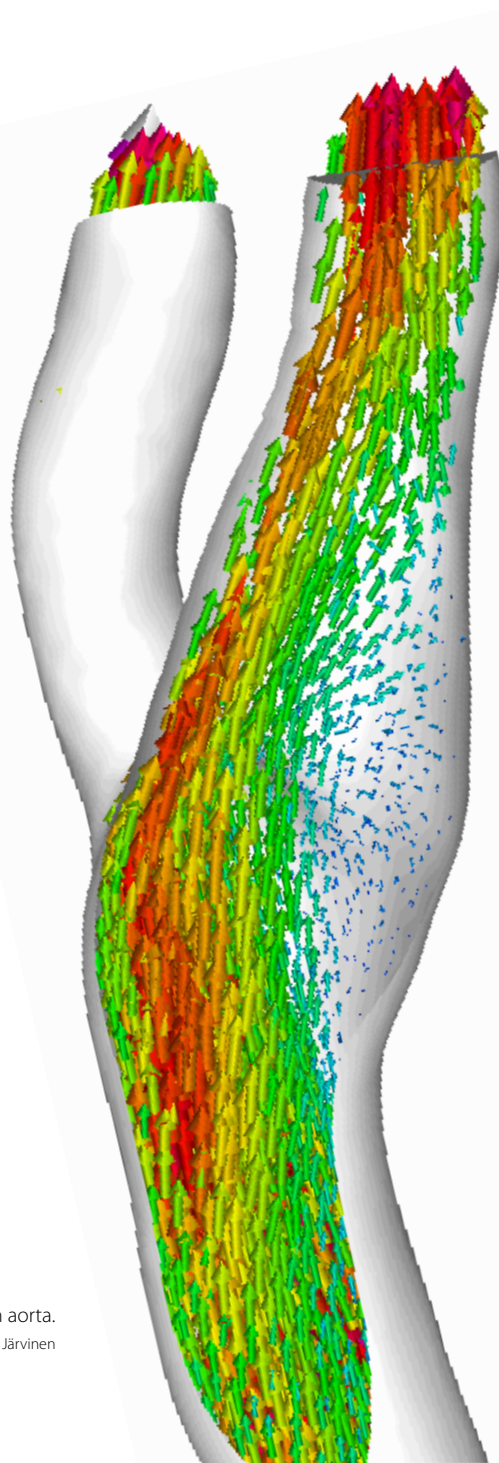
ElmerGUI is the graphical user interface for defining and generating the input data for ElmerSolver. ElmerGUI is capable of creating 2D and 3D Delaunay partitionings and importing external meshes produced by other software. The module is intended for fast prototyping, testing, and educational purposes.

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 customers' questions concerning the basic use and capabilities of Elmer, our mailing lists provide help and support directly from the developers and user community. For customers with special needs we provide contracted individual support.



Velocity field of blood flow in aorta. Copyright Esko Järvinen



CSC, the Finnish IT center for science, is a non-profit company providing IT support and resources for academia, research institutes and companies. CSC is administered by the Ministry of Education.

Further information

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