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Elmer - finite element package for the solution of partial differential equations

Wednesday 9 May 2007 17:30 (20 minutes)

Describe the scientific/technical community and the scientific/technical activity using (planning to use) the EGEE infrastructure. A high-level description is needed (neither a detailed specialist report nor a list of references).

Elmer is a versatile finite element package for the solution of partial
differential equations. It is particularly well suited for the study of generic
2D and 3D problems involving coupling between different physical phenomena.
It has already been used to solve several multi-physics problems.

The planned ELMER use under the NA4 for the Earth Sciences Applications includes
environmental models, focusing in glasiological and ground water simulations.

Report on the experience (or the proposed activity). It would be very important to mention key services which are essential for the success of your activity on the EGEE infrastructure.

Elmer has been applied to some mediumsize problems in glaciology e.g. in
nonlinear flow problems.Models such as thermo-mechanical coupling including a
numerical correct treatment of pressure-melting point limit, anisotropy as well as
prognostic runs
have been implemented. A Poisson type of equation solved with Elmer has proved
to excellently scale up to 200 processors on an AMD Opteron-Infiniband cluster.

Elmer is dynamically developing system, so there is possibility for updates. The EGEE
should enable these updates easily. New physical models are linked as dll:s
(dynamically linked libraries). Some problems might arise from running ELMER in
heterogenious MPI environments.

With a forward look to future evolution, discuss the issues you have encountered (or that you expect) in using the EGEE infrastructure. Wherever possible, point out the experience limitations (both in terms of existing services or missing functionality)

Coupling flow, transport, temperature etc. with ELMER multiphysics and multiscale
capabilities

enable versatile problem staments and models for coupled systems.
The future is in
larger
spacial and temporal simulations.

Describe the added value of the Grid for the scientific/technical activity you (plan to) do on the Grid. This should include the scale of the activity and of the potential user community and the relevance for other scientific or business applications

ELMER combines the basic fields of classical physics:
computational fluid
dynamics, computational solid mechanics, computational
electromagnetics,
heat transfer, structural mechanics. As a multiphysics
environment, the main added
value is in coupling these phenomena. There are existing
applications in: crystal
growth, mems, acoustics, microfluidics. Earth sciences is a
rising application area:
glasiology, ground water modelling. The scale of activity is to
model local,
transitory events as case studies. The
potential user community are earth scientist, either in academic
or governemental
institutions. The relevance comes from the growing need of
environmental models, and
the need to couple several phenomena.

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