Università degli Studi di Pavia

Dipartimento di Meccanica Strutturale

in collaboration with

Centro di Simulazione Numerica Avanzata – CeSNA

Istituto Universitario di Studi Superiori

SEMINAR

Analysis and Applications of Isogeometric Finite Elements

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Since November we have been working on fast implementations of B-spline/NURBS based finite element solvers, written using PETSc. PETSc is frequently used in software packages to leverage its optimized and parallel implementation of solvers, however we also are using PETSc data structures to assemble the linear systems. These structures in PETSC (called DA's) were originally intended for the parallel assembly of linear systems resulting from finite differences. We have reworked this structure for linear systems resulting from isogeometric analysis based on tensor product spline spaces. The result of which is a framework for solving problems using isogeometric analysis which is scalable and greatly simplified over previous solvers.

This infrastructure has enabled research in the performance of higher continuous spaces. When presenting convergence results, it is common to see plots of a measure of error versus numbers of degrees of freedom. In some sense, these plots link the accuracy of a discretization (error) to the cost (numbers of degrees of freedom). However, this ignores the cost of the linear solver. We studied the cost of solving linear systems resulting from higher continuous finite element spaces when using a direct solver and discovered that higher continuous linear systems can cost up to 2-3 times more time and memory to solve than their C^0 counterparts. Our infrastructure has also allowed us to develop scalable solvers for a variety of problems. We have chosen to pursue nonlinear time dependent problems, such as: Cahn-Hilliard; Navier-Stokes-Korteweg; Variational Multiscale for Navier-Stokes; Diffusive Wave Approximation to Shallow Water Equations.

We also have solvers for an assortment of linear problems: Poisson, Elasticity, Helmholtz, Advection-Diffusion, and Diffusion-Reaction. All solvers are written to be inherently parallel and run on anything from a laptop to a super computer such as Shaheen, KAUST's IBM-BlueGeneP supercomputer.

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Venerdì 29 Aprile, Ore: 14.00 (precise)
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