

Salzburg Mathematics Colloquium

Summer 2017

Ulrich Langer (Linz)

“Multi-patch discontinuous Galerkin space and space-time isogeometric analysis”

March 30, 2017

Extended Abstract:

In the first part of the talk, we introduce and investigate multi-patch discontinuous Galerkin (dG) Isogeometric Analysis (IgA) approximations to elliptic heterogeneous diffusion problems. Our numerical error analysis covers low-regularity solutions, non-matching meshes, and segmentation crimes like non-matching interfaces creating gaps and overlaps. The two main efficiency bottlenecks in IgA are the generation and the solution of the IgA equations. We construct and analyze new dual-primal Isogeometric Tearing and Interconnecting (IETI-DP) methods for solving large-scale linear systems of algebraic equations arising from dG IgA discretization of diffusion problems on multi-patch domains with non-matching meshes and interfaces. IETI-DP methods are well suited for parallelization. The parallelization not only considerably accelerates the generation but also the solution via dG-IETI-DP technology. For instance, one can generate and solve a system of 18 million higher-order IgA equations in about 2 seconds using 1024 cores of the RICAM supercomputer RADON 1.

In the second part of the talk, we present and analyze new stable single-patch and multi-patch space-time IgA method for the numerical solution of parabolic diffusion problems in fixed and moving spatial computational domains. The discrete bilinear form is elliptic on the IgA space with respect to a discrete energy norm. This property together with a corresponding boundedness property, consistency and approximation results for the IgA spaces yields an a priori discretization error estimate with respect to this discrete energy norm. The theoretical results are confirmed by several numerical experiments with low- and high-order IgA spaces on serial and parallel computers.

The research work presented in this talk is a joint work with C. Hofer, S. Moore, M. Neumüller and I. Touloupoulos, and has been supported by the Austrian Science Fund (FWF) under the grant NFN S117-03.

Thursday, 15:00-15:45

Hörsaal 414, 1. Stock

Fachbereich Mathematik

Universität Salzburg

Hellbrunnerstraße 34

5020 Salzburg

AUSTRIA

www.uni-salzburg.at/mathematik