**Semilinear fractional elliptic PDEs: analysis and discretization**

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In this talk we will study the existence, regularity, and approximation of solution to fractional semilinear elliptic PDEs. We identify minimal conditions on the nonlinear term and the source which leads to existence of weak solutions and uniform $L^{\infty}$-bound on the solutions. Next we realize the fractional Laplacian as a Dirichlet-to-Neumann map via the Caffarelli-Silvestre extension. We introduce a first-degree tensor product finite element space to approximate the truncated problem. We derive a priori error estimates and conclude with a numerical example. In this talk we consider time step control for variational-monolithic fluid-structure interaction. The fluid-structure interaction system couples the incompressible Navier-Stokes equations with geometrically nonlinear elasticity resulting in a nonlinear PDE system using the arbitrary Lagrangian-Eulerian approach. As the Navier-Stokes equations are of parabolic type and the solid equations of hyperbolic nature, they ask for different conservation properties that should be reflected in their temporal discretization. To circumvent this difficulty we use a dual-weighted residual error estimator for a Fractional-Step-$\theta$ timestepping scheme. The algorithm for temporal adaptivity is based on a Gelerkin interpretation of the Fractional-step theta time-stepping scheme and a rigorous derivation of dual-weighted sensitivity measures. All developments are substantiated with several numerical tests that include FSI-benchmarks with appropriate extensions and a flapping membrane example.