Universidad de Concepción

CI²MA Centro de Investigación en Ingeniería Matemática

SEMINARIO JORNADAS DE PRIMAVERA:

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Expositor:

Filánder Sequeira

Escuela de Matemática, Universidad Nacional, Campus Omar Dengo, Heredia, Costa Rica

Título de la Charla:

An L^p spaces-based mixed virtual element method for the two-dimensional Navier-Stokes equations

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Sala Multiuso, Centro CI²MA
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Resumen

In this talk we extend the utilization of the Banach spaces-based formulations, usually employed for solving diverse nonlinear problems in continuum mechanics via primal and mixed finite element methods, to the virtual element method (VEM) framework and its respective applications. More precisely, we propose and analyze an L^p spaces-based mixed virtual element method for a pseudostress-velocity formulation of the two-dimensional Navier-Stokes equations with Dirichlet boundary conditions. To this end, a dual-mixed approach determined by the introduction of a nonlinear tensor linking the usual pseudostress for the Stokes equations with the convective term, is employed. As a consequence, this new tensor, say $\boldsymbol{\sigma}$, and the velocity $\mathbf{u}$ of the fluid constitute the unknowns of the formulation, whereas the pressure is computed via a postprocessing formula. The simplicity of the resulting VEM scheme is reflected by the absence of augmented terms, on the contrary to previous works on this and related models, and by the incorporation in it of only the projector onto the piecewise polynomial tensors and the usual stabilizer depending on the degrees of freedom of the virtual element subspace approximating $\boldsymbol{\sigma}$. In turn, the non-virtual but explicit subspace given by the piecewise polynomial vectors of degree $\leq k$, is employed to approximate $\mathbf{u}$. The corresponding solvability analysis is carried out by using appropriate fixed-point arguments, along with the discrete versions of the Babuška-Brezzi theory and the Banach-Nečas-Babuška theorem, both in subspaces of Banach spaces. A Strang-type lemma is applied to derive the *a priori* error estimates for the virtual element solution as well as for the fully computable approximation of $\boldsymbol{\sigma}$, the postprocessed pressure, and a second postprocessed approximation of $\boldsymbol{\sigma}$. Finally, several numerical results illustrating the performance of the mixed-VEM scheme and confirming the rates of convergence predicted by the theory, are reported.

Posterior a la charla se podrá conversar con el expositor sobre sus experiencias