
Contribution ID: **224** Type: **Oral Presentation**

# Fixed Stress Splitting for Coupled Flow and Poromechanics

*Tuesday, 1 June 2021 14:40 (15 minutes)*

Professor Andro Mikelić is known for his seminal mathematical contributions to flow in porous media. In this presentation we summarize how his work has impacted the development of numerical models coupling flow and poromechanics arising in geosciences and biosciences applications such as subsidence events, carbon sequestration, groundwater remediation, hydrocarbon production, and hydraulic fracturing, enhanced geothermal systems, solid waste disposal, and biomedical multiple-network poroelastic theory MPET modeling. We focus on the Biot model that consists of a poromechanics equation coupled to a flow model with the displacement and pressure as unknowns. In contrast to solving the Biot system fully implicitly, we consider a fixed stress iterative scheme that allows the decoupling of the flow and mechanics equations. The decoupling scheme offers several attractive features such as the use of existing flow and mechanics codes, use of appropriate preconditioners and solvers for the two models, and ease of implementation. The design of this approach is currently quite popular in engineering studies due to its importance in the formulation of efficient, convergent, and robust schemes. Professor Mikelić's work on establishing a contractive property of this and several other iterative schemes has led to many theoretical and computational practical extensions, one of which we discuss in detail.

In this presentation we discuss the Biot system solved with a fixed-stress split, Enriched Galerkin (EG) discretization for the flow equation, and Galerkin for the mechanics equation. Residual-based a posteriori error estimates are established with both lower and upper bounds. These theoretical results are confirmed by numerical experiments performed with the Mandel's problem. The efficiency of these a posteriori error estimators to guide dynamic mesh refinement is demonstrated with a prototype unconventional reservoir model containing a fracture network.

## Time Block Preference

Time Block B (14:00-17:00 CET)

## References

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**Presenter:** WHEELER, Mary

**Session Classification:** MS24

**Track Classification:** (MS24 - Invitation Only) Mathematical and computational challenges related to porous media - Special session in memory of Andro Mikelic