Contribution ID: **193** Type: **Oral Presentation**

On the Equations of Nonlinear Single-Phase Poroelasticity

Tuesday, 1 June 2021 14:55 (15 minutes)

In this presentation we consider the equations of nonlinear poroelasticity derived from mixture theory. They describe the quasi-static mechanical behavior of a fluid saturated porous medium. The nonlinearity arises from the compressibility of the fluid and from the dependence of porosity and permeability on the divergence of the displacement. We point out some limitations of the model. In our approach we discretize the quasi-static formulation in time and first consider the corresponding incremental problem. For this, we prove existence using Brezis's theory of pseudo-monotone operators. Generalizing Biot's free energy to the nonlinear setting we construct a Lyapunov functional, yielding global stability. This allows us to construct bounds that are uniform with respect to the time step. If dissipative effects between the fluid and the solid are taken into account, resulting in an additional time derivative, we obtain the continuous time case in the limit when the time step tends to zero. This yields existence of a weak free energy solution. This is joint work with Andro Mikelic to whom this mini-symposium in dedicated.

Time Block Preference

Time Block C (18:00-21:00 CET)

References

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Primary author: VAN DUIJN, Cornelis Johannes (Hans) (Eindhoven University of Technology)

Presenter: VAN DUIJN, Cornelis Johannes (Hans) (Eindhoven University of Technology)

Session Classification: MS24

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