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## Flow of a fluid with pressure-dependent viscosity through aging porous media

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Considerable experimental evidence in a variety of porous materials (concrete, ceramics, bones, rocks) that undergo infinitesimal deformations makes it clear that material moduli depend on the density (identified as density dependence of Young's modulus).

The phenomenon of material damage is a consequence of the inhomogeneity of the body as material properties deteriorate with deformation.

This is especially relevant for subsurface flows through geological media which have experienced deformation over millenia.

However, the most widely used models for subsurface flow (such as Darcy/Brinkman model) typically assume that the porous medium is a rigid skeleton. Even if one moves onto theories of poroelasticity, the porous solid is assumed to be a linearized elastic solid with constant values of material properties such as Young's modulus.

Within the framework of linearized elasticity, modelling damaged porous media with a density dependent Young's modulus is inconsistent and untenable due to the assumption of infinitesimal displacement gradient. However, it is possible to incorporate density-dependent material moduli in the framework of implicit constitutive theories where the kinematic variable (strain) is expressed as a function of the stress.

Such a viewpoint remains unexplored in the context of flow of a fluid through porous media, and we shall illustrate the effect of damage by comparison with existing theories that ignore it completely.

### Participation

In-Person

### References

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