



Antonio Di Carlo

Percolation and absorption in a (soft) porous matrix

Venerdì 24 febbraio, ore 15:00

Abstract

In a joint paper with Paolo Podio Guidugli, Salah Naili and Vittorio Sansalone, I recently finalised an extended poroelastic theory apt to describe fluid trafficking between the channelling pores and the surrounding matrix. This talk is meant to bring the underlying ideas to the attention of the local community of soft-matter mechanicians. While the softness of the matrix does not play an essential role in our theory, we expect some of the effects it covers to be more dramatic if the solid skeleton is soft.

The theory is framed in a non-conventional virtual power format, where a key role is played by compatibility of test velocities with mass balance, no matter whether mass exchanges between interstitial and absorbed fluid are allowed. I proceed in three steps, describing the kinematics, balance laws and constitutive theory of a saturated porous solid exchanging mass with an incompressible interstitial fluid. Our general format can accommodate fluid compressibility and partial saturation, but I will exclude these effects to focus on mass exchanges.

I will barely touch upon constitutive modelling issues, where the real challenge lies. In tackling such issues, educated physical imagination and careful consideration of the underlying processes at pore scale are needed. As an example, think of the subtleties of the nonlinear feedback arising when the fluid flow itself transforms the porosity characteristics of the medium, a fact that in turn affects how the fluid flows. To unravel these intricate phenomena, great promise is held by the growing capability to characterise the micro-geometry of porous media with unprecedented resolution, and to produce, analyse, and simulate down to sub-pore resolution, micro-models with controllable porosity characteristics. In conclusion, this is an invitation “to cross the boundary from the continuum mechanics of solids towards the physical chemistry of porous solids” (as enunciated by the late Coussy).

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Note biografiche



Laureato in ingegneria nel 1969. Professore di prima fascia di Scienza delle Costruzioni dal 1986, all'Università di Roma La Sapienza fino al 31 ottobre 1992, quindi all'Università Roma Tre fino al 14 aprile 2015. Professore ordinario di Fisica Teorica della Materia all'Università Roma Tre dal 15 aprile 2015.

Tra le principali linee di ricerca ci sono: modelli multi-scala in fisica dei materiali; integrazione tra dinamica molecolare e meccanica dei mezzi continui e microstrutturati: materia soffice, nemato-acustica, tessuti biologici; integrazione tra modellazione fisica e modellazione geometrica; topologia algebrica e geometria differenziale in fisica dei mezzi continui.