

"All is flux" -- Heraclitus

Cross-diffusion Triggered Wave Instabilities

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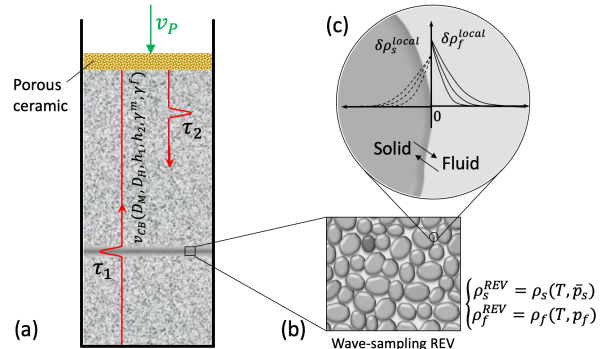
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- Consider a **concurrent** scenario of primary and secondary consolidation processes in a porous *viscoplastic* medium^[1]:

1-D Hydro-Poro-Mechanics based on thermodynamics			
	Thermodynamic Force (1-D)	Thermodynamic Flux (1-D)	Conservation Law (no cross-diffusion)
H	$F_H = \frac{\partial p_f}{\partial x}$	$q_H = -\frac{D p_f}{D t}$	$\frac{D p_f}{D t} = D_H \frac{\partial F_H}{\partial x} + r^f$
M	$F_M = \frac{\partial \bar{p}_s}{\partial x}$	$q_M = -\frac{D \bar{p}_s}{D t}$	$\frac{D \bar{p}_s}{D t} = D_M \frac{\partial F_M}{\partial x} + r^M$

- How to manifest the possible **time-dependent interactions** "around" the solid-fluid interface?



- Cross-diffusion** in a complex system: the phenomenon when a generalized thermodynamic force induces a generalized thermodynamic flux of another kind.

$$\frac{\partial \bar{p}_s}{\partial t} = D_M \frac{\partial^2 \bar{p}_s}{\partial x^2} + d_H \frac{\partial^2 p_f}{\partial x^2} + R_1,$$

$$\frac{\partial p_f}{\partial t} = d_M \frac{\partial^2 \bar{p}_s}{\partial x^2} + D_H \frac{\partial^2 p_f}{\partial x^2} + R_2,$$

Mixture theory

+

Inter-constituent mass transfer

+

Relaxing the adiabatic constraints on the reaction part of the system

