Fachbereich 4
Produktionstechnik
Maschinenbau &
Verfahrenstechnik

CENTER OF
APPLIED SPACE TECHNOLOGY
AND MICROGRAVITY
ZARM

Fluids and Space Engineering Seminar

Date: Tuesday, July 5, 2022 at 14:15
Location: ZARM, Room 1730

Oscillatory flow in elastic structures: Implications for pore scale modeling and the design of artificial dampers

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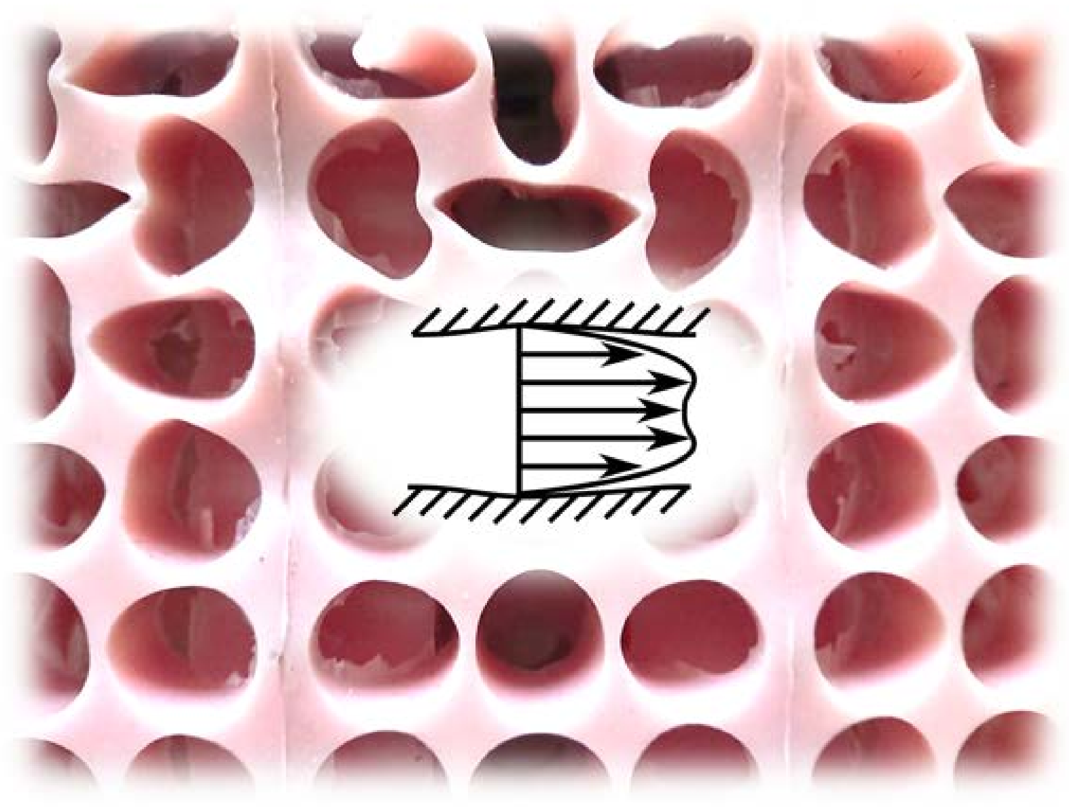

This talk aims at exploring the interaction between oscillatory flow and deformable structures for two purposes: (I) pore scale modeling in geophysics and (II) the design of artificial low-frequency dampers.

(I) For the first part, oscillatory flow of air and water was excited experimentally at frequencies up to 250 Hz in tubes of steel and silicone. The resulting standing flow waves reflect viscosity-controlled diffusive behavior and inertia-controlled wave behavior for frequencies relatively low and high compared to Biot's critical frequency, respectively. Rigid-tube theories correspond well with the experimental results for steel tubes filled with air or water. The wave modes observed for silicone tubes, however, require accounting for the solid's shear and bulk modulus to correctly predict the speed of pressure propagation and deformation modes. The shear mode may even be responsible for significant macroscopic attenuation in porous materials.
(further reading: http://dx.doi.org/10.1121/1.4971365)

(II) In the second part, we explore material architectures that lead to enhanced dissipation properties by taking advantage of squirt-flow - a local flow mechanism triggered by heterogeneities at the pore level. While squirt-flow is a known dominant source of seismic dissipation, we study its untapped potential to be incorporated in highly deformable elastic materials with embedded fluid-filled cavities for future engineering applications. Particular architectures are then investigated via numerical simulations showing that a careful design of the internal voids can lead to an increase of dissipation levels by an order of magnitude, compared with equivalent homogeneous void distributions.
(further reading: http://dx.doi.org/10.1016/j.jmps.2017.08.003)