# The 18th Global-COE International Frontier Seminar

## March 26th, 2010, from 16:30, at the room#486 meeting room 4F

# Combined flexural and torsional oscillation methods for laboratory study of viscoelasticity and poroelasticity


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Although torsional oscillation methods have been intensively used in seismic-frequency laboratory studies of shear mode viscoelasticity, much less attention has been paid to the relaxation of the bulk modulus. However, the dissipation of compressive energy and associated partial relaxation of the bulk modulus are potentially vitally important in those parts of the Earth containing a relatively compressible fluid phase (aqueous fluid or melt) or coexisting low- and high-pressure crystalline phases. This phenomenon is also experimentally accessible with forced-oscillation methods - involving either alternating compression and extension (as in Li and Weidner's recent work) or flexure. Here we will describe progress in the development of flexural oscillation methods for use alongside the established torsional mode capability of our ANU laboratory. Our experimental assembly is a cylindrical beam comprising sections of varying cross-section fabricated from steel and polycrystalline alumina, along with the rock specimen, assembled in series within a close-fitting metal sleeve. In flexure, the beam functions as a propped cantilever, driven by an electromagnetically applied time-varying bending moment, and the resulting flexure is measured at two locations within the beam by parallel-plate capacitance displacement transducers sensitive to the local angle of flexure. The polarity of the drivers and of the capacitance displacement transducers can be reconfigured to allow the same experimental assembly to be studied in either torsional or flexural oscillation. Preliminary experimental results for flexural oscillation of a fused silica specimen, under conditions of room temperature and high pressure within an argon gas-charged pressure vessel, are closely consistent with expectations from exploratory modelling with a crude finite-difference approximation, in which the role of shear stress is neglected. Furtherprogress in development of the flexural mode capability will be reported, including finite-element modelling of the stiffening effect of shear stress; understanding and modelling the perturbing influence of interaction between the oscillating specimen assembly (especially the capacitance displacement transducers) and the dense argon pressure medium; and development of a practical strategy for inversion of the relative amplitudes and phase of the measured angles of flexure to infer the complex Young modulus of the viscoelastic (or poroelastic) specimen.


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