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A new set-up for measuring the mechanical properties of porous materials

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A new device for determining complex Young's modulus of porous materials in a extended frequency range is proposed.
Classical methods are based on quasitatic or dynamic response of porous material. These methods generaly neglect the coupling between the surrounding fluid and the porous frame so that they are restricted to low frequency range (<100 Hz) or specific sample shape. Dynamic methods provide relevant information only at the resonance frequencies of the frame.
The proposed method extends the quasistatic method towards high frequencies : 1. the porous sample is set up in a cavity in order to avoid the coupling with the external fluid, 2. a specific electrodynamic transducer has been developped to get the mechanical impedance of the sample from the measurement of the electrical impedance, 3. mechanical properties of the frame are derived by inverse method using Biot theory so that the frequency range is not restricted to the quasistatic domain.
First results obtained with a prototype validate the method in comparison with two classical methods.