ACOUSTICS2008/2563
Acoustic field in a spherical resonator: effect of modal coupling due to small perturbations

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The international community recently recommended a re-definition of the kelvin referring to the value of the Boltzmann constant k, which must thus be known with a relative uncertainty of 10^{-6}. The measurement of the acoustic resonance properties of a gas filled spherical or quasi-spherical resonator is an appropriate method to do this with these requirements.
Actually, a detailed modeling of the acoustic field in the resonator is required for the determination of k. Several phenomena must be taken into account including heat conduction, shear and bulk viscosity of the gas, the real shape of the resonator, the acoustic input impedance of small acoustic elements flush-mounted on the wall (tubes, transducers)... Significant theoretical studies have already been done in which these perturbations are accounted for separately, the coupling between them being neglected.
The scope here is thus to provide a unified model for the acoustic field in the cavity including all these perturbations and the resulting modal coupling, and applying it on a simple practical configuration: a spherical resonator filled with argon, acoustic transducers being flush-mounted on the wall.