ACOUSTICS2008/3485
Uncertainty of power and intensity measurement in focused fields

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[DRAFT ONLY - TO BE UPDATED] Currently, the methodology employed to measure acoustic intensity and acoustic power relies on the plane wave assumption, resulting in a simple relation between acoustic power and the normal component of the radiation force vector, and acoustic intensity and pressure magnitude. For a range of ultrasonic transducers, and for positions in the field beyond the last axial maximum, this assumption is a valid one. Nevertheless, there is a range of situations where the plane wave assumption may introduce significant uncertainty in the measurement, such as in near field measurements and in fields resulting from highly focused devices.
This investigation looks at the acoustic fields generated by axisymmetric rigidly vibrating curved pistons over a range of diameters and radii of curvature at megahertz frequencies. Finite element and boundary element methods are used to evaluate the acoustic pressure field and the components of the particle velocity vector at specified field positions. The time-averaged acoustic intensity vector, the acoustic power, as well as the normal component of the radiation force vector on a perfectly absorbing target may then be derived. Experimental results are will also be presented comparing theory with radiation force measurements and with the new and more accurate buoyancy change method.