

**Experimental Evidence for Maximum Efficiency Operation of a Magnetostrictive Transducer**

Experimental broad-band testing of a magnetostrictive transducer has been used to study the trade-off between operating for maximum efficiency and maximum output. Although the largest output displacement or acceleration is achieved at the resonant frequency, a greater operating efficiency is achieved at a frequency above resonance. An explanation for this phenomenon for general transducers via the theory of electroacoustics is reviewed [Hunt, Frederick V., *Electroacoustics: The Analysis of Transduction, and its Historical Background*. Acoustical Society of America, 1982.]. The frequency of maximum efficiency is derived for a general electromagnetic transducer and shown graphically on a motional-impedance locus plot. An evaluation of the efficiency shows that the reactance, the imaginary component of the electrical impedance, can be "tuned" to achieve maximum efficiency. For a magnetostrictive transducer the reactance tuning is related to reducing eddy losses. The effective permeability of the material is shown to decrease significantly after resonance, well below the nominal value at low frequency, thus operating in this frequency region results in a significant decrease in eddy current losses and hence a higher efficiency. Experimental results are provided to demonstrate the advantages of operating a transducer at the maximum efficiency frequency.