

ACOUSTICS2008/1289 Magnetostrictive Compacted Sonar Transducer Design

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A compact modular high power magnetostrictive sound source that is capable of producing scanning Cardioid beams every 45 degrees in the horizontal plane and operates over one octave has been fabricated. The device consists of 8 transducer elements in the form of a ring that radiates acoustic energy radially outward. This design uses the operation principles of a piezoceramic transducer of similar design [J.L. Butler and A.L. Butler, J. Acoust. Soc. Am. 119, 3409 (2006)], which operated in a higher frequency band. The sound source can be driven to form Omni-directional, Dipole and Quadrupole beam patterns. By combining the measured electrical drive and acoustic pressure amplitude and phase coefficients of these beam patterns a narrower type Cardioid beam pattern is generated. The transducer elements are of a Tonpilz type vibrator consisting of magnetostrictive Terfenol-D drive rods sandwiched between radiating head mass and a tail mass that is common to all elements with tie bolts consolidating the parts together. The Terfenol-D rods are interlaced with rare earth magnets to provide the DC magnetic bias field for the AC drive field provided by a coil. FEA models using ATILA and COMSOL are used for structural and magnetic analysis predictions of the device. [Work supported by ONR]