

NONDESTRUCTIVE EVALUATION (NDE) AND ACTUATION MECHANISMS USING PLATE WAVES

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ABSTRACT

For many years, plate waves have been the subject of NDE research and application studies. Plate waves, also known as Lamb waves, can be formed in two distinct modes: symmetric and anti symmetric. Initially, these waves were applied to NDE of metallic structures. Following the speaker's observation of the leaky Lamb waves in composites, the spot light of plate waves research was turned towards anisotropic materials. Many researchers have investigated solutions to the wave equations for wave propagation in these materials and efficient approximation techniques were developed. Recently, the accumulated knowledge have been used to develop actuation mechanisms such as ultrasonic motors. The surface particles in a traveling flexural plate wave mode (i.e. antisymmetric mode) are moving elliptically. At and near the peak position, the particles move parallel to the surface and propelling any part that is in intimate contract with the vibrating plate. The rotation mechanism that is produced by the surface displacement is harnessed in the form of ultrasonic motors. This technology is developed to support various space and aircraft needs including the development of a robotic arm for sample collection on Mars as well as to activate a crawler that can climb on aircraft surfaces to inspect difficult to reach areas. The speaker will review JPL's activities in NDE and advanced actuators.

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