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Modeling of Magnetostrictive Patch Transducers for Guided Wave Simulation in a Plate

***Yoon Young Kim[1], Kyung Ho Sun[2], and Joo Hwan Oh[1]**

[1]WCU Multiscale Design Division, School of Mechanical and Aerospace Engineering, Seoul National University, 599 Gwanak-ro, Gwanak-gu, Seoul 151-744, Korea.
[2] Department of System Dynamics, Korea Institute of Machinery & Materials, 104 Sinseongno, Yuseong-Gu, Daejeon 305-343, Korea

*Corresponding author: yykim@snu.ac.kr

This work aims to present finite element modeling for Magnetostrictive Patch Transducers (MPT's) that are used to generate ultrasonic guided waves for non-destructive inspection of plates. While MPT's consisting of thin magnetostrictive patches, electric coils and magnets are being used in various applications, there appears no finite element model or simulation result to predict the wave radiation pattern of the elastic waves generated by them. Because the bias magnetic field by magnets is usually non-uniform in a magnetostrictive patch not only in magnitude but also in direction, the simplification of the field as uniform bias field results in erroneous predictions. Here, we present an effective two-step linearized modeling technique of MPT's and use it to predict the wave radiation pattern in a plate by MPT's. Time-harmonic analysis in was used for elastic wave calculations and the resulting simulations of radiation patterns were compared with experimental results.