On the Prediction of Guided Wave Dispersion Curves in Plates for Health Monitoring Applications

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Abstract.
In the last years, a significant interest has been pointed out in the capability of ultrasonic guided waves as candidate tool for Structural Health Monitoring, due to their high damage detection sensitivity and low requested power consumption. The monitoring of the structural health through the propagation of guided waves is complex: some waves phenomena, such as dispersion and slowness ones, together with boundary scattered waves, may mask the presence of damages. So, studying the dispersion phenomenon through the solution of the dispersion equation, i.e., dispersion curves, may be helpful in understanding the propagation mechanisms. As dispersion equations of Lamb waves are high-order transcendental equations, they do not generally have analytical solutions. For this reason, the development of a prediction model can be a valuable tool for the improvement of SHM systems, avoiding the high cost of experimental campaigns. The Finite Element (FE) method appears to be the best candidate for such type of simulation. Thus, once the FE model is calibrated with respect to an experimental test case, the developed model can be used to simulate and predict guided-wave propagation mechanisms in a given structure. This leads to the possibility of employing the aforementioned approach to identify and localise potential structural damages, that is the final aim of an SHM system. In this work, the FE method, together with an in-house code, has been used to investigate guided wave dispersion phenomenon in plates for possible SHM applications.