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FLEXURAL WAVE BAND GAPS IN PHONONIC CRYSTAL EULER-BERNOULLI BEAM USING WAVE SPECTRAL ELEMENT METHOD

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During the last years many researches have been interested in the field of wave propagation in periodic structures called phononic crystals (PCs). The PCs are characterized by presenting heterogeneous inclusions with periodic distribution. Due to its periodic structure, some frequency ranges may exist where elastic waves are forbidden to propagate (band gaps). Recently, new techniques to analyze PCs are using a combination of analytical or numerical method with wave propagation. One is called wave spectral element (WSE) method and it consists of combining the spectral element (SE) method with the Floquet-Bloch's theorem. Other similar technique is the wave finite element (WFE) method. The WFE method utilizes a similar approach where SE method is substituted by the conventional finite element (FE) method. In this study, band gaps in a phononic crystal Euler-Bernoulli (EB) beam containing unit cells of aluminium and epoxy are investigated using the WSE, WFE, SE and FE methods. These techniques are utilized to obtain the transmittance, receptance and the frequency response function (FRF). The WSE and WFE methods are also utilized to predict the PC band structure. The attenuation constant surface is obtained by the WSE method. It is possible to achieve Bragg gaps formation in low frequencies considering a small number of unit cells. The behavior of the attenuation constant surface is complex and varies according to the number of unit cells. The best attenuation was found to four unit cells with approximately 50% of epoxy. The PC Euler-Bernoulli beam proposed indicates the potential to achieve band gap formation for vibration management.