Guided waves in piezoelectric cylindrical structures with sector cross-sections

B Zhang[1], *†J.G Yu[1] and X.M Zhang[1]

[1]School of Mechanical and Power Engineering, Henan Polytechnic University, China

*Presenting author:yuee@hpu.edu.cn
†Corresponding author:yuee@hpu.edu.cn

Abstract

As a kind of attractive functional material, piezoelectric materials have the ability to convert electrical energy and mechanical energy to each other. So piezoelectric materials are widely used in many applications, such as sensors, non-destructive testing and communication technology and the like. Because the performance of piezoelectric devices have a close relationship with materials properties and wave characteristics, wave characteristics in piezoelectric material structures have drawn a lot of attentions. Recently, for the purpose of the design, manufacture and optimization of piezoelectric sensors, wave propagation in piezoelectric cylindrical structures with sector cross-sections is also paid more and more attentions.

Based on three-dimensional piezoelasticity theory, guided waves in piezoelectric cylindrical structures with sector cross-sections are investigated by introducing the double orthogonal polynomial series method into the cylindrical coordinate system. Comparing with available reference results, the validity of the present method is confirmed. The influence of convergence for the present method is analyzed. The corresponding phase velocity dispersion curves, displacement and electric potential distributions are illustrated. The influences of the variation of radius to thickness ratio and angular measure on guided wave characteristics are discussed. Investigation results will provide significant guidance on the design, manufacture and optimization of piezoelectric sensors.

Keywords: Piezoelectric material; Sector cross-sections; The double orthogonal polynomial series method; Dispersion curves

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