

综述评论

轴向运动弦线的纵向振动及其控制

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摘要 综述轴向运动弦线纵向振动及其控制问题的研究进展. 多种工程系统如动力传送带、磁带、纸带、纺织纤维、带锯、空中缆车索道等均涉及轴向运动弦线的纵向振动. 对线性模型而言, 除早期结果外, 总结了运动弦线的模态分析、具有复杂约束和耦合的运动弦线振动和运动弦线参数振动的近期研究. 对非线性模型而言, 提出了轴向运动弦线大幅纵向振动的运动微分方程, 概述了离散化和直接近似解析分析、用黏弹性材料模型化阻尼机制和动力传输系统的耦合振动研究的新进展. 讨论了轴向运动弦线振动主动控制的研究现状, 包括能控性和能观性, 控制分析的频域方法和能量方法, 振动的自适应控制和非线性振动的控制. 最后指出该研究方向今后需要研究的若干重要问题, 包括运动弦线的非线性动力学行为、黏弹性运动弦线的振动、含运动弦线的混杂系统的控制和轴向运动弦线非线性振动的控制.

关键词 [轴向运动弦线](#) [线性振动](#) [参数振动](#) [非线性振动](#) [主动振动控制](#)

分类号

TRANSVERSE VIBRATION OF AXIALLY MOVING STRINGS AND ITS CONTROL

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Abstract

Investigations on transverse vibration of axially moving strings and its control are reviewed. Transverse vibration of axially moving strings is involved in many engineering devices such as power transmission belts, magnetic tapes, paper tapes, thread lines, band saws, and aerial cable tramways. In the context of linear models, besides a few early results, recent studies on modal analysis of moving strings, vibration of constrained and coupled moving strings, and parametric vibration of moving strings are summarized. In the context of nonlinear models, the equations of motion of moving strings with large amplitude are presented, and new progresses on discretized and direct approximate analytical analysis, modeling of damping mechanisms as viscoelastic materials, and coupled vibration of power transmission systems are surveyed. The state-of-the-art in active control of moving strings vibration, including controllability and observability, the frequency domain analysis and the energy analysis, adaptive vibration control, and nonlinear vibration control, is discussed. Some topics for future research, such as nonlinear dynamical behavior of moving strings, vibration of moving viscoelastic strings, control of hybrid systems containing moving strings and control of nonlinear oscillations of moving strings, are suggested.

Key words [axially moving string](#) [linear vibration](#) [parametric vibration](#) [nonlinear vibration](#) [active vibration control](#)

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