

具有边界控制的线性Timoshenko型系统的指数稳定性

杜燕, 许跟起

天津大学数学系, 天津 300072

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摘要 研究多孔弹性材料在实际应用中的稳定性问题. 多孔物体的动力学行为由线性Timoshenko型方程描述, 这样的系统一般只是渐近稳定但不指数稳定. 假定系统在一端简单支撑, 另一端自由, 在自由端对系统施加边界反馈控制, 讨论闭环系统的适定性和指数稳定性. 首先, 证明了由闭环系统决定的算子 \mathcal{A} 是预解紧的耗散算子、生成 C_0 压缩半群, 从而得到了系统的适定性. 进一步通过对系统算子 \mathcal{A} 的本征值的渐近值估计, 得到算子谱分布在一个带域, 相互分离的, 模充分大的本征值都是 \mathcal{A} 的简单本征值. 通过引入一个辅助算子 \mathcal{A}_0 , 利用算子 \mathcal{A}_0 的谱性质以及算子 \mathcal{A} 与 \mathcal{A}_0 之间的关系, 得到了 \mathcal{A} 的广义本征向量的完整性以及Riesz基性质. 最后利用Riesz基性质和谱分布得到闭环系统的指数稳定性.

关键词 [线性Timoshenko型系统](#), [边界反馈控制](#), [Riesz基](#), [指数稳定性](#).

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Exponential Stability of a System of Linear Timoshenko Type with Boundary Controls

DU Yan, XU Genqi

Department of Mathematics, Tianjin University, Tianjin 300072

Abstract In the present paper the stabilization problem of porous elastic solids is considered. The kinetic behavior of porous solids is governed by equations of linear Timoshenko type which is generally asymptotically stable but not exponentially stable. For the exponential stability, boundary velocity feedback controls are applied with one end clamped and the other free. Firstly, it is shown that the operator determined by the system is dissipative and generates a C_0 semigroup. Hence the well-posed-ness of the system follows from the semigroup theory of bounded linear operators. Secondly, the asymptotic behavior of eigenvalues of \mathcal{A} is obtained under certain condition. Moreover by using an auxiliary operator \mathcal{A}_0 , and by means of spectral properties of \mathcal{A} and \mathcal{A}_0 , it is proven that there is a sequence of generalized eigenvectors of \mathcal{A} which forms a Riesz basis for Hilbert state space. Finally, the exponential stability of the closed loop system is given by use of the Riesz basis property and spectral distribution of \mathcal{A} .

Key words [Linear Timoshenko type system](#) [boundary feedback control](#) [Riesz basis](#) [exponential stability](#).

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