On the Control Problem of the Vibrating Systems with Distributed Parameters

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Abstract: In this paper, we consider a control problem for one-dimensional vibrating systems independent of time and having non-homogeneous distributed parameters which are not in equilibrium at given initial states but after a finite time interval which will be in equilibrium. We show that this control problem is equivalent to the control problem in Hilbert space $L_2[0,T]$. Consequently, the solution of the moment problem in Hilbert space can be used for the solution of the control problems of the waves in non-homogeneous media with distributed parameters.

Key words: The Control of Wave Processes, Moment Problem, Vibrating system, Hilbert space $L_2[0,T]$.

Homojen Olmayan Dağılmış Parametreli Ortamlarda Dalgaların Yayılma ve Kontrol Problemleri Üzerine

Özet: Bu makalede, bir boyutlu zamandan bağımsız homojen olmayan dağılmış parametreli titreşim sistemleri için verilen başlangıç halinde denge durumunda olmayan fakat sonradan sonlu zaman aralığında denge durumuna getirilen kontrol problemi ele alındı. Bu kontrol problemi $L_2[0,T]$ Hilbert uzayındaki kontrol problemine denk olduğu gösterilmiştir. Sonuç olarak, homojen olmayan dağılmış parametreli ortamlarda dalgaların kontrol probleminin çözümü Hilbert uzayındaki moment probleminin çözümüne getirildi.

Anahtar Kelimeler: Dalga Proseslerinin Kontrolü, Moment Problemi, Titreşim Sistemi, $L_2[0,T]$ Hilbert Uzayı.

Introduction

Recently, controlling of wave processes in non-homogeneous media is an interesting problem from the theoretical and practical points of view. The control problem for elastic wave propagation in composite media is used commonly in mechanics and in seismology (see, e.g. [2]). The control problem was first converted into the equivalent moment problem by Krasovskiy [7]. He solved the optimal control problem of the system, expressed by ordinary linear differential equations, by reducing it to the equivalent moment problem of finite order [2, 8]. The control problem for the linear systems with distributed parameters by reducing it to the equivalent moment problem of infinite order was solved by Butkovskiy [1]. In this study, the solution of the control problem for the vibrating system is reduced to the solution of the equivalent moment problem of a trigonometric system in Hilbert space $L_2[0,T]$.

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