A Study of Evolutional Control Systems

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Abstract : Controllability is one of the fundamental issues in control systems. In this paper, we study the controllability of second order evolutional control systems in Hilbert spaces with memory and boundary controls, which model dynamic behaviors of some viscoelastic materials. Transferring the control problem into a moment problem and showing the Riesz property of a family of functions related to Cauchy problems for some integrodifferential equations, we obtain a general boundary controllability theorem for these second order evolutional control systems. This controllability theorem is applicable to various concrete 1D viscoelastic systems and recovers some previous related results. It is worth noting that Riesz sequences can be used for numerical computations of the control functions and the identification of new Riesz sequence is of independent interest for the basis-function theory. Moreover, using the Riesz sequences, we obtain the existence and uniqueness of (weak) solutions to these second order evolutional control systems in Hilbert spaces. Finally, we derive the exact boundary controllability of a viscoelastic beam equation, as an application of our abstract theorem.

Conference Title : ICMCS 2018 : International Conference on Mathematics and Computational Science
Conference Location : New York, United States
Conference Dates : June 03-04, 2018