Boris P. Belinskiy* (bbelinsk@cecasun.utc.edu), University of Tennessee-Chattanooga, and **Sergei A. Avdonin** (ffsaa@uaf.edu), University of Alaska-Fairbanks, *Some New Developments in Exact Control Theory and the Method of Moments*

We study the exact controllability for a flexible elastic string fixed at the end points under an axial stretching tension that slowly varies in time. We say that the string is controllable if, by suitable manipulation of the transverse load, the string goes to the rest. We are looking for an exterior transverse load that drives the state solution to the rest. To prove our results we apply the method of moments that has been widely used in control theory for distributed parameter systems (cf. the classical papers of H.O. Fattorini and D.L. Russell). The problem of exact controllability is reduced to a moment problem for the control. The proof of controllability is based on an auxiliary basis property result that is of independent interest.

The results of this paper may be considered as a generalization of the classical results on controllability for one-dimensional wave equation. The main difference between our problem of control and the classical results is that in our case, the coefficient of the wave equation (tension in our model) is a function of time. As a result, the functions that substitute non-harmonic exponential functions may not be found explicitly. This fact complicates the analysis of controllability. We use some results on the bases of non-orthogonal functions due to M.G. Krein. To the best of our knowledge, our work is the first attempt to apply the method of moments to equations with time dependent coefficients. We outline some possible applications (such as control of oscillations of a system of connected thin elastic cylinders imitating blood vessels, control that would stabilize unnecessary oscillations of a propeller of a helicopter, etc.).

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