1014-35-442 **Krstic Miroslav*** (krstic@ucsd.edu), Dept MAE, University of California, San Diego, Mail Code 0411, La Jolla, CA 92093-0411. *Backstepping boundary controller and observer designs for the slender Timoshenko beam.*

We present the first extension of the backstepping methods to hyperbolic PDEs. We introduce controller and observer designs capable of adding damping to a model of beam dynamics using actuation only at the beam base and using sensing only at the beam tip. Interestingly, the backstepping method does not apply to the simplest Euler-Bernoulli model but does apply to more realistic models, including the Timoshenko beam model under the assumption that the beam is "slender." For our method to be applicable it is necessary that the beam model includes a small amount of Kelvin-Voigt damping. Such damping models internal material friction and is present in every realistic material. We don't use the KV damping as a source of dissipation but as a means of controllability of the beam. With only a small amount of KV damping present in the uncontrolled system, we are able to introduce a substantial amount of damping of classical type (velocity-based). The closed-loop system can be transformed into a form where both the added damping and an addition of "stiffness" are evident. As we show, this simultaneous change in damping and stiffness results in an overall shift of the eigenvalues to the left in the complex plane and in the improvement of the damping ratio of all the eigenvalues. (Received September 15, 2005)