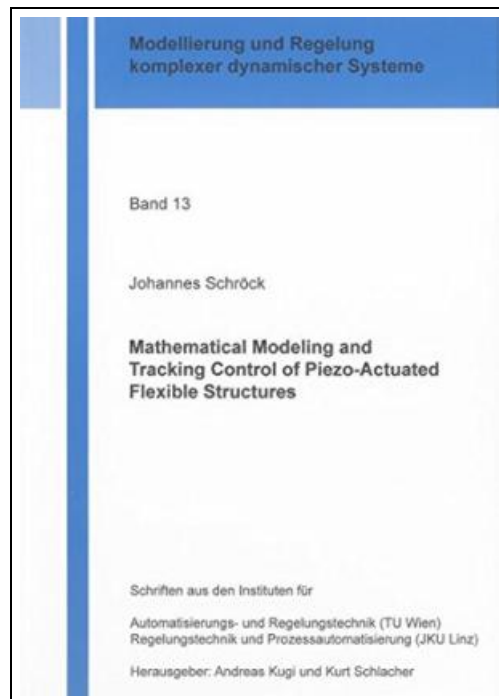


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(Dr. Gabriella Hayes)

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Shaker Verlag Mai 2012, 2012. Buch. Book Condition: Neu. 24x17x cm. Neuware - This work is concerned with the mathematical modeling, the analysis and the control of flexible structures in form of elastomechanical beams and plates equipped with surface-mounted piezoelectric patches. Piezoelectric materials allow an efficient conversion between electrical and mechanical energy and can be used as both sensors and actuators depending on whether the direct or the indirect piezoelectric effect is utilized. Here, a finite number of piezoelectric patches represent spatially distributed actuators, which induce individual strain components depending on the orientation and the voltage supply of the patch actuator. In the last decades, much attention has been paid to these piezo-actuated flexible structures in view of active vibration control. In contrast, this work focuses on tracking control. The presented tracking control design allows to change the deflection profile of the flexible structures along prescribed trajectories with high accuracy and robustness. Thereby, a model-based control design is performed. Flexible structures lead to distributed-parameter models in terms of partial differential equations. The patch actuators locally influence the mechanical properties like stiffness and damping such that spatially varying parameters arise. In addition, the nonlinear behavior of the piezoelectric actuators due to hysteresis and creep effects has to be considered. However, experimental results show that the application of an adequate hysteresis and creep compensator yields a linear actuator behavior. The tracking control design directly utilizes the distributed-parameter description of the considered model and contains motion planning and feedforward control, hysteresis and creep compensation, as well as feedback control and state observer concepts. Besides the theoretical derivations of the control strategy including the proof of the closed-loop stability measurement results from different laboratory test benches confirm the applicability of the proposed approach. Thereby, highly dynamic rest-to-rest transitions for deflection profiles of piezo-actuated flexible...



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