SM17L_11223

XXI International Congress of Theoretical and Applied Mechanics
Warsaw, Poland, August 15–21, 2004

Low Energy Control of Periodic Motions in Manufacturing

Nils Guse, Werner Schiehlen

Institute B of Mechanics, University of Stuttgart, Stuttgart, Germany

Flexible manufacturing processes require different periodic motions which may be realized by an active robot. A well established robot control principle is inverse dynamics which is used to overcome the high nonlinearities typical for mechanical systems undergoing large displacement motions. However, this principle results in high energy demand. This paper presents two methods for designing linear and nonlinear springs as local energy storage devices to improve the efficiency of nonlinear rheonomic systems such as assembly robots. Firstly, the shooting method is applied to find parameters of a mechanical system resulting in a conservative limit cycle close to the desired trajectory. The second method describes an alternative approach to design a system with low energy consumption by fitting the spring characteristics to an optimal force function calculated by inverse dynamics. Both methods yield impressive energy savings despite of the additional fine tuning control.

View the extended summary