Numerical study of parametric effects on the dynamic response of planar multi-body systems with differently located frictionless revolute clearance joints.

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Abstract

This paper numerically investigates the parametric effects of differently located frictionless revolute clearance joints on the overall dynamic characteristics of a multi-body system. A typical planar slider–crank mechanism is used as a demonstration case in which the effects of clearance size and the input speed on the dynamic response of the mechanism with a revolute clearance joint between the crank and connecting rod, and between the connecting rod and slider are separately investigated with comprehensive observations numerically presented. It is observed that, different joints in a multi-body system have different sensitivities to the clearance size, and changing the driving speed of a mechanism makes the behavior of the mechanism to change from either periodic to chaotic, or chaotic to periodic depending on which joint has clearance. Therefore the dynamic behavior of one clearance revolute joint cannot be used as a general case for a mechanical system. Also the location of the clearance revolute joint, the clearance size and the operating speed of a mechanical system, play a crucial role in predicting accurately the dynamic responses of the system.