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综述评论

柔性多体系统动力学实验研究综述

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摘要 介绍了国内外柔性多体系统动力学实验研究现状, 分为三个方面, 即理论模型验证实验、动力学特性的实验研究和其它实验. 柔性多体系统动力学建模理论的发展经历了3个阶段：运动-弹性动力学(KED)方法、传统混合坐标方法和计及了动力刚化效应的各种非线性理论. 关于这些理论的模型验证实验均在本文中作了重点介绍. 文中还对柔性多体系统动力学性态的研究实验也作了介绍, 包括系统模态特性和共振等非线性力学行为. 关于机械臂控制和碰撞研究实验虽有提及, 但不作为重点. 随后, 着重介绍了柔性体弹性振动位移的测量和阻尼因素的处理这两个在实验不可避免但又难以解决的问题, 尤其是结构阻尼和大范围运动引起的空气阻力. 最后指出了今后的研究方向. 文中对一些较为重要的实验装置也着重予以介绍, 并给出了部分实验图片及数据曲线, 以给读者一个更好的理解和参考.

关键词 柔性多体系统 动力学 实验 模型验证 测量 阻尼

分类号

SURVEY OF EXPERIMENTS FOR DYNAMICS OF FLEXIBLE MULTIBODY SYSTEM

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Abstract

This paper presents a survey of experiments dedicated to the study of dynamics of flexible multibody systems. Topics include verification of theories, experimental investigation on dynamics characteristics, and other test work such as contact-impact experiment. The development of the dynamics of flexible multibody systems involves three stages: Kineto-Elasto Dynamics Method (KED), traditional hybrid coordinates method and non-linear theories taking into account the dynamic stiffening effect. The related experiments used for the verification of these theories are described in detail. The experiments on the dynamics characteristics of flexible multibody system, such as modal frequencies and modal shapes and resonance researches, are also discussed. The experiments on the control of manipulator and contact-impact researches are briefly mentioned. Two key problems in experiments are discussed in detail. One is how to measure the deformation of flexible body undergoing large overall motions, the other is how to deal with the effects of damping such as internal damping and air drag forces. Finally, some current and future research directions are pointed out. In this paper, some of experiments are described with figures containing the experiment setup and data plotting.

Key words flexible multibody system dynamics experiment model verification measurement damping

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