Paper ID: 63822
oral
student

IAF MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Smart Materials and Adaptive Structures (9)

Author: Dr. Zhang Yuhang
Beihang University (BUAA), China

Dr. Jiang Jun
Beijing Institute of Control Engineering(BICE), China Academy of Space Technology(CAST), China
Mr. Zhang Qiang
Beijing Institute of Control Engineering(BICE), China Academy of Space Technology(CAST), China
Dr. Sun Ruijie
Beihang University (BUAA), China
Dr. Zhang Xiaoyong
Beihang University (BUAA), China

A NOVEL SPACE BEARINGS UNLOADING MECHANISM USING SCREW PAIRS AND SHAPE MEMORY ALLOYS

Abstract

Ball bearings are a key component of aerospace shafting. To resist the dynamic load during launch, bearings are usually applied a large preload which can also contribute to a large friction torque when operating on-orbit. This leads to less bearing life and more power consumed. So as to meet the need of high preload during launch as well as low preload on-orbit, variable preload techniques for space application have been investigated over the decade. However, existing techniques were usually designed for soft preload bearing and can't be implemented in hard preload bearing which is widely used in aerospace shafting. Also, previously variable preload techniques may cause problems in space applications due to its structure complexity and additive equipment. To develop variable preload technique for hard preload space bearing, a novel unloading mechanism is proposed in this study. Using shape memory alloys actuator and screw pairs to convert rotary motion into linear motion, the mechanism can generate axial displacement of 0.03mm and can be operated reversely. Due to the self-locking property of screw pairs, it can maintain high preload during launch. And when operating on-orbit, the circumferentially arranged shape memory alloys wire is heated and drives screw pairs to generate axial displacement between the bearing outer ring. Theoretical analysis is carried out for verifying the design feasibility. A prototype system has been fabricated and tested, the results are compared with the analytical results. It is shown that the friction torque of bearing is reduced apparently after operating and the variable preload mechanism proposed in this study is applicable to aerospace shafting.