AUTHOR: Yekta Gursel

CO-AUTHORS: Elizabeth McKenney

CORRESPONDENCE: Jet Propulsion Laboratory, California Institute of Technology, Mail Stop 306-388, 4800 Oak Grove Drive, Pasadena, CA 91109. Telephone: (818) 354-3645 Fax: (818) 393-9471

E-MAIL ADDRESS: Yekta.Gursel@jpl.nasa.gov

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ABSTRACT:

The SIM Interferometry Test Bed 3 (STB3) is a spaceborne stellar interferometer simulator built and operating at JPL. Its construction details and performance are described elsewhere in this conference.

The Test bed consists of an interferometer system built on a large, floating optical table, and a star simulator built on another large optical table placed directly across it. The optical tables float on independent, air-filled, suspension legs simulating the SIM spacecraft and the distant stars it is to observe.

The SIM stellar interferometer is required to reject slow (sub Hz) motions of the spacecraft by feeding the attitude information from the bright-star tracking interferometers to the dim-star science interferometer, so that the photon-starved dim-star interferometer star tracking system can hold the science object in the field of view of the interferometer, without losing track of the interferometer fringes. The design is also required to reject the translation induced path-length errors in the science and the tracking interferometers.

In order to demonstrate these performance requirements, a novel attitude control system has been built and installed on the STB3 test bed. The attitude control system consists of 8 specially designed drive coils mounted to the ground and 8 very strong, permanent magnets (strongest ever made) mounted on the star simulator. The coils that are designed to allow the magnets move by at +- 5 mm are driven by audio amplifiers and they can generate a minimum 10 N of force per coil. The option of chilled water cooling is built into the coils to enable DC attitude alignment as well as very large AC amplitude drive that requires larger forces than 10 N per coil. The design of the

system is such that the ground motions do not couple into the optical table motion to first order, hence the system is also a seismic isolation enhancer (up to 50 Hz, where coil inductive reactance attains a value equal to the coil resistance).

The audio amplifiers are driven by digital to analog converters hooked up to the computers that run interferometer software. The sensing of the relative motion of the tables to the required accuracy is achieved by using dual spot-size quadrant diode systems and heterodyne gauge heads.

In this paper, the details of the design, construction and performance of the attitude control system will be presented. The attitude control system has been used to meet certain SIM requirements. An example of this performance test is also included.

The research described is performed at the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration.

KEY WORDS: Spaceborne interferometry, attitude control, star simulator

BRIEF BIOGRAPHY:

The author is a member of the technical staff in the Interferometry Metrology and Optics group of the Interferometry and Large Optical Systems section at JPL. After getting his Ph. D. from Caltech, he has worked in the Gravitational Physics Group at Caltech, in the Artificial Intelligence Laboratory at MIT and in the LIGO Project at Caltech as a Staff Scientist.
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