

Dim star fringe stabilization on the SIM Test-Bed 3 using pathlength feed-forward of the "guide" interferometer optical path variation.

Renaud Goullioud[°], Oscar S. Alvarez-Salazar[#], Bijan Nemati^{*}

[°] Jet Propulsion Laboratory, 4800 Oak Grove Dr, Pasadena, CA 91109

[#] TRW, One Space Park, Redondo Beach, CA 90278

Oral presentation

BIOGRAPHY

Dr. Renaud Goullioud has an engineering degree (1994) in electronics from the Institute of Chemistry and Physics of Lyon (France) and a Ph. D. in micro-electronics. He has been working at JPL in the Interferometry Technology Program since 1997, as an optical engineer. He has developed several optical test-beds related to the SIM mission. Since 2000, he has been the lead of the SIM Test-Bed 3.

ABSTRACT

Future space-based optical interferometers such as the Space Interferometer Mission require fringe stabilization to the level of nanometers in order to produce astrometric data at the micro-arc-second level. Even the best attitude control system available to date will not be able to stabilize the attitude of a several thousand pound spacecraft to a few milli-arc-seconds. Active pathlength control is usually implemented to compensate for the attitude drift of the spacecraft. This issue has been addressed in previous experiments while tracking bright stars. In the case of dim stars, as the sensor bandwidth falls below one hertz, feedback control will not provide sufficient rejection. However, stabilization of the fringes from a dim-star down to the nanometer level can be done open loop using the information from additional interferometers looking at bright guide stars.

The STB3 testbed developed at the Jet Propulsion Laboratory features three optical interferometers sharing a common baseline, dynamically representative to the SIM interferometer. An artificial star feeding the interferometers is installed on a separate optics bench. Voice coils are used to simulate the attitude motion of the spacecraft by moving the entire bench. Data measured on STB3 shows that the fringe motion of a dim star due to the spacecraft attitude change can be attenuated by more than 60dB at 0.1Hz without feedback control, using only information from the two guide stars. This paper will describe both the STB3 setup, the pathlength feed-forward architecture and the data collected with the system and how they relate to SIM.

KEY WORDS: Interferometry, SIM, real-time control, testbed, attitude control

[°] Send correspondence to: M/S:171-113, Phone: 818 354 7908, renaud@jpl.nasa.gov

[#] Send correspondence to: M/S: R4-1112, Phone: 818 393 5952, Oscar.Alvarez-Salazar@trw.com

^{*} Send correspondence to: M/S: 301-486, Phone: 818 354 0883, bnemati@jpl.nasa.gov