

STABILIZATION OF A FIBER OPTIC LINK USING A TEMPERATURE CONTROLLED FIBER SEGMENT

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Abstract

The Deep Space Network (DSN) of the National Aeronautics and Space Administration (NASA) is operated by the Jet Propulsion Laboratory (JPL), California Institute of Technology. The DSN uses fiber optics to distribute frequency and time to remote sites which may be as far as 26 km from the main control center. The fiber optic cables are buried 1.5 m underground. At this depth the only apparent temperature variation is that due to seasonal variations, with a pseudo-sinusoidal behavior with a one year period. The resulting stability of the references at the remote sites is well within the requirements of the DSN. However, the radio science requirements for the Cassini mission are much more stringent and the existing performance does not meet these requirements. The particular antenna to be used for the Cassini mission is 16 km from the main control center and the apparent temperature variation (as measured by the delay variation) is 11 °C peak to peak over the year. By inserting a temperature controlled section of cable whose temperature is controlled in such a manner as to force the total delay variation to be constant, the annual variation (and small variations due to storm fronts passing through the area) can be reduced to a negligible amount. The length of this inserted section for this application is 3.6 km and the temperature variation over the year of this section is 50°C. Details of the design and preliminary results are given.

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