A MEO-GEO Combined Earth Sensor/Sun Sensor

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This paper discusses the design and performance characteristics of a combined earth sensor/sun sensor for use in the MEO (13,000 km) to GEO orbital altitude range, including super GEO altitudes up to 77,000 km.

This combined sensor has been developed for use on a current GEO spacecraft series, and has been delivered.

The earth sensor provides a ±30° x ±15° acquisition range, an accuracy ±0.02°, and a highly linear readout range of ±6° x ±3°, over which this accuracy applies.

The integral sun sensor, which is coaligned with the earth sensor, provides a ±60° azimuth x ±30°elevation sun readout field, in which the sun's angular position is read out to ±0.01° over a sensor temperature range of 0°C to +70°C.

The total weight of this combined sensor is 6 watts.

The paper describes the opto-mechanical configuration of the earth sensor, which incorporates a mirror scan drive bearing system capable of an orbital life exceeding 25 years, and a scan motor with digital encoder-based commutation providing a scan speed constancy at its 2 rps rotation rate of better than 1%.

The horizon location processing of the earth is entirely digital, and compensates out any non-linearities in its readout angular range through the use of on-board look-up tables. Similar look-up tables are also used in the integral sun sensor to provide the high accuracy sun angular locations over its wide field of view.

The automated test and simulation equipment, which provides the calibrated inputs for these detailed look-up tables, as well as alignment capabilities corresponding to the high sensor accuracies, is also described.

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