Case Study
Structural Health Monitoring
FAST radio telescope
China

Solutions>Structural Health Monitoring

Background

The Five-hundred-meter Aperture Spherical radio Telescope (FAST), nicknamed Tianyan ("Sky's/Heaven's Eye"), is a radio telescope located in the Dawodang depression, a natural basin in Pingtang County, Guizhou, southwest China.FAST has a fixed 500 m (1,600 ft) diameter dish constructed in a natural depression in the landscape. It is the world's largest filled-aperture radio telescope and the second-largest single-dish aperture, after the sparsely-filled RATAN-600 in Russia.
It has a novel design, using an active surface made of metal panels that can be automatically tilted to help change the focus to different areas of the sky.The cabin containing the feed antenna, suspended on cables above the dish, can move automatically by using winches to steer the instrument to receive signals from different directions.
Construction of FAST began in 2011. It observed first light in September 2016. After three years of testing and commissioning, it was declared fully operational on 11 January 2020.

Challenge

FAST being built in Guizhou has an active reflector system with a spatial span of 500 meters and involves many links and equipment. In order to ensure its long-term normal operation, traditional manual inspections are far from satisfactory. Therefore, it is very necessary to apply modern health monitoring technology to it.The 500-meter-caliber spherical radio telescope FAST is a giant radio telescope built in Guizhou karst depressions. Its active reflecting surface system is mainly composed of lattice columns, ring beams, cable nets, reflecting panels, and actuators. It is necessary to ensure that the telescope is being constructed And the safety of each structure during operation.

Solution

According to the analysis of the design institute's analysis of the FAST active reflector system's environmental temperature, structural component temperature, ring beam stress, main cable force, ring beam deformation and other parameters, the influence of the uneven temperature difference in sunlight on the support structure of the FAST active reflector , The wind field characteristics of the active reflective surface, to identify the effects of temperature gradients on stress, cable force and ring beam deformation, researchers have established statistical models of stress and temperature, cable force and temperature, and eliminated the influence of various influencing factors on stress. Based on this situation, CGEO provided the FAST radio telescope health monitoring system, including several Temperature Sensor,Vibrating Wire Spot Weldable Strain Gauge,Fiber grating strain gauge, demodulator etc., installed on the radio telescope lattice column, ring beam, and main cable network, through which the strain sensor monitors the force and deformation state of the set point, thereby monitoring the structure of the radio telescope Safety and reliability of use. The present invention has good EMC performance and does not produce electromagnetic influence on the work of the radio telescope. Using CGEO instruments and a capable Partner effectively showing that quality and reliability can be cost-effective.

Products link

Vibrating Wire Spot Weldable Strain Gauge
Fiber Grating Strain Gauge
Temperature Sensor
Demodulator
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