Space-compatible strain gauges as an integration aid for the James Webb Space Telescope Mid-Infrared Instrument - DTU Orbit (18/08/2019)

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Space instruments are designed to be highly optimised, mass efficient hardware required to operate in extreme environments. Building and testing is extremely costly, and damage that appears to have no impact on performance at normal ambient conditions can have disastrous implications when in operation. The Mid-Infrared Instrument is one of four instruments to be used on the James Webb Space Telescope which is due for launch in 2018. This telescope will be successor to the Hubble Space Telescope and is the largest space-based astronomy project ever to be conceived. Critical to operation of the Mid-Infrared Instrument is its primary structure, which provides both a stable platform and thermal isolation for the scientific instruments. The primary structure contains strain-absorbing flexures and this article summarises how these have been instrumented with a novel strain gauge system designed to protect the structure from damage. Compatible with space flight requirements, the gauges have been used in both ambient and cryogenic environments and were successfully used to support various tasks including integration to the spacecraft. The article also discusses limitations to using the strain gauge instrumentation and other implications that should be considered if such a system is to be used for similar applications in future.

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