

Vibration Monitoring & Control Next Generation Space Telescopes

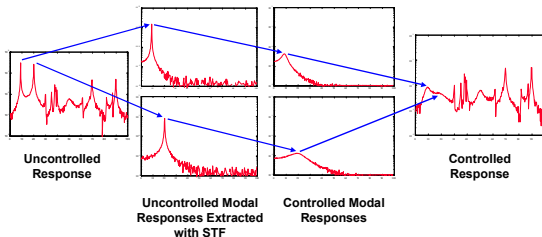
Problem: Develop active and passive vibration control strategies to maintain space telescope mirror positions with 10 nanometer accuracy under thermal and vibration loads.

Space Telescope Challenges

The need for improved resolution has prompted the U.S. Dept. of Defense (DoD) to consider building large deployable space telescopes made up of multiple mirrors. In order for such a system to work, the relative positions of the mirrors must be maintained with an accuracy of 10 nanometers in the presence of thermal gradients and on-board jitter disturbances. NASA is also planning future missions to use deployable space telescopes to search deep space for blue planets like Earth.

Dual-Use Technology

SDL is currently funded by DoD under a Phase II SBIR contract to develop cutting edge vibration monitoring and control technology for large space telescopes. Concurrently, SDL is applying this technology to improve our industrial clients' manufacturing processes and quality control.

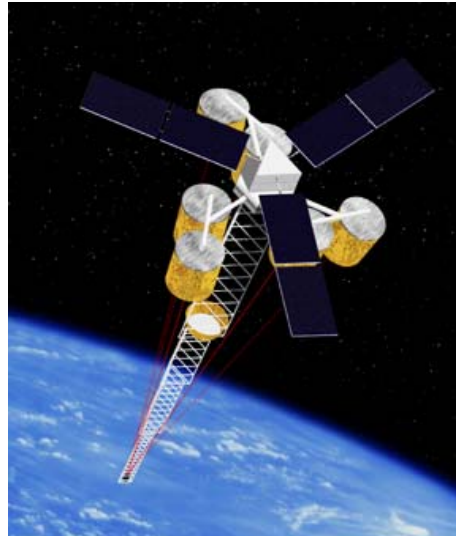


STF Based Control

Spatio-Temporal Filtering

Spatio-Temporal Filtering (STF) uses a small number of structure mounted sensors (e.g., strain gauges or accelerometers) to adaptively track or control individual modes of vibration. STF is ideally suited for systems whose dynamic characteristics change during operation, which can include both spacecraft and manufacturing

Solution: Apply system-level modeling to determine optimal balance of structural modifications, passive damping and active vibration control. Refine solutions on scale-model test beds before full-scale implementation.



Air Force Research Laboratory
Deployable Space Telescope Concept

systems. Adaptive STF-based controllers are robust; they can adapt to sensor and actuator failures. A factor of ten vibration reduction is typical for structures SDL has controlled including beams, plates, space trusses, and highway bridges.

Industrial Applications

Spatio-Temporal Filtering concepts are currently being applied to two industrial applications. The first involves the stabilization of a continuous, five foot wide steel strip during hot-dip galvanization. The reduction in strip vibration will result in material cost savings and improve the quality of the finished product. STF concepts have also contributed to the understanding and improvement of a mechanical device used to measure fluid process parameters.

SDL

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