Optomechanical Systems Engineering

This course emphasizes a systems-level overview of optomechanical engineering. Starting with the fundamentals of imaging, it reviews how optical system concepts flow down into optomechanical requirements on optical fabrication, alignment, structural design, mechanics of materials (metals, composites, and glasses), structural vibrations, thermal management, and kinematic mounts. The focus is on the fundamental principles underlying real-world design problems, as well as the commercial off-the-shelf (COTS) components used to solve them.

LEARNING OUTCOMES

This course will enable the student to:

- utilize the basic concepts and terminology of optical engineering required for the development of optomechanical components;
- read conventional and ISO-10110 drawings used for the fabrication of lenses ;
- develop an alignment plan with an emphasis on critical tolerances, alignment mechanisms, and "go-no go" decisions for adjusting tilt, decenter, despace, and defocus;
- quantify the ability of a structural design to maintain alignment using efficient architectures and lightweight materials; compare low-strain lens and mirror mounts for reducing wavefront error (WFE);
- utilize the results of STOP (structural-thermal-optical) analysis for the deflection and distortion of 0ptical components under static loads; estimate the impact of stress concentrations and contact tresses; select optical materials with appropriate structural properties;
- estimate the effects of vibration environments on the alignment of optomechanical systems; select COTS components for vibration isolation;
- predict the effects of conductive, convective, and radiative thermal environments on the performance of optical systems; select materials and off-the-shelf hardware to manage the effects of heat loads and temperature changes;
- compare kinematic and semi-kinematic mounts and the limitations of COTS hardware.

INTENDED AUDIENCE

Intended for engineers (systems, optical, mechanical, and electrical), scientists, technicians, and managers who are developing, specifying, or purchasing optical, electro-optical, infrared, or laser systems.