Optical Systems Engineering Class

Optical systems engineering emphasizes first-order, system-level estimates of optical performance. Building on the basic principles of optical design, this course uses numerous examples to illustrate the systems-engineering processes of requirements analysis, feasibility and trade studies, subsystem nterfaces, error budgets, requirements flowdown and allocation, component specifications, and vendor selection. Topics covered will include an introduction to systems engineering, geometrical optics, aberrations and image quality, radiometry, optical sources, detectors and FPAs, optomechanics, and the integration of these topics for developing a complete optical system.

LEARNING OUTCOMES

This course will enable the student to:

- utilize the concepts and terminology of systems engineering as applied to optical system development;
- calculate geometrical-optics parameters such as image size, image location, FOV, IFOV, and ground-sample distance (GSD);
- distinguish the various types of optical aberrations; estimate blur size and blur-to-pixel ratio, and their effects on MTF, ground-resolved distance (GRD), and image quality;
- quantify radiometric performance, using the concepts of optical transmission, f/#, etendue, scattering, and stray light;
- compare source types and properties; estimate radiometric performance; develop source selection specifications and tradeoffs such as output power, irradiance, radiance, uniformity, stability, and SWaP;
- compare FPA and detector types and properties; predict SNR performance combining optical, source, and detector parameters; develop detector-selection specifications and tradeoffs such as sensitivity, dynamic range, uniformity, operability, and SWaP;
- explain optical component specifications; estimate thermal, structural, and dynamic effects on
- the performance of an optical system; utilize the results of STOP analysis and error budgets

INTENDED AUDIENCE

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

Prerequisites include a familiarity with Snell’s law, the lens equation for simple imaging, and the concepts of wavelength and wavefronts.