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HelioCon
Heliostat Consortium for Concentrating Solar-Thermal Power

Heliostat Consortium Seminar Series

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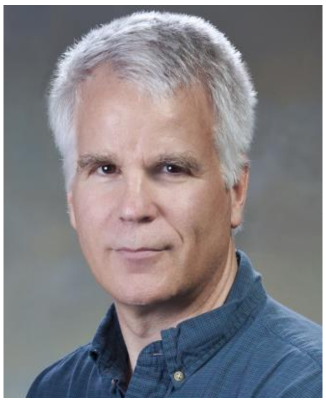

Dr. Randy Brost
Technical Staff, Sandia National Laboratories
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Host: Dr. Rebecca Mitchell

Title: Challenges and Solutions in Heliostat Optical Metrology

When: September 27th 1-2 PM MDT

Zoom: https://nrel.zoomgov.com/j/1613394621

Abstract:

Among the primary concentrating solar collector configurations (trough, dish, linear Fresnel, heliostats), heliostats are unique because they can simultaneously deliver very high temperature and very high power. For example, heliostat solar fields can achieve temperatures over 1000 °C and over 100 MWth power. But these results are only possible if the heliostats have high optical accuracy. Optical errors in heliostat shape, pointing, and control can all contribute to a degradation in overall system performance, with error targets approaching 0.6 mrad (0.04°). These tolerances must be held over enormous sizes. Total heliostat field apertures often exceed 106 m^2, comprised of many thousands of heliostats with individual apertures sometimes exceeding 150 m^2. Heliostats appear flat but are curved optics, with very long focal lengths sometimes exceeding 1.5 km, and often including intentional astigmatism. These optical factors, combined with the harsh outdoor desert environment, make effective heliostat metrology a very challenging problem. This presentation will review the fundamentals of heliostat optics and explain how the important heliostat metrology problems are shaped by the heliostat development phase and operating environment. We will review currently available solutions, and then provide a detailed review of systems developed at the Sandia National Laboratories Concentrating Solar Optics Laboratory for measuring heliostat optical performance, both indoors and outdoors. These include high-resolution measurement methods and high-speed airborne methods designed to survey entire heliostat fields. We will conclude with a review of key open problems in heliostat metrology.

Bio:

Dr. Randy Brost is a technical staff member at Sandia National Laboratories in the Concentrating Solar Power Technology group. He is currently leading projects related to concentrating solar optics and autonomy. He received his Ph.D. in Computer Science from Carnegie-Mellon University in 1991 and performed robotics research at Sandia National Laboratories until 1997. He then served at Eastman Kodak Company until 2007, implementing a variety of custom software tools supporting advanced manufacturing, metrology, and physics analysis. He then joined SkyFuel, a concentrating solar power company, where he helped develop utility-scale solar collectors, and applied computational methods to optimize new solar collector designs. He returned to Sandia in 2011 and pursued a variety of computer science research topics before joining the Concentrating Solar Technology group in early 2020.