Synchrotron X-Ray Diagnostics for Multiphase and Complex Flows

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Abstract

The past several decades have seen a tremendous increase in the use of optical diagnostics to make non-intrusive measurements of turbulent fluid flows. While these techniques have led to important insights in many flows, there are several flowfields of research interest that are difficult to access with optical diagnostics. Examples include optically dense multiphase flows (such as sprays and cavitating flows), sooting flames, and flows inside optically opaque objects. For these flowfields, x-ray diagnostics provide an alternative method of non-intrusive measurements. While researchers have for several years used laboratory x-ray sources to great effect to measure such flowfields, the capabilities afforded by synchrotron x-ray sources can allow measurements at higher speed and resolution than is often possible with laboratory sources. This presentation will discuss the physics behind several x-ray diagnostics, as well as their application to a range of multiphase and complex flowfields. The relative advantages and drawbacks of synchrotron sources and laboratory x-ray sources will also be discussed.

Biography

Alan Kastengren received his B.S. in Mechanical Engineering from Iowa State in 2001 and his Ph.D. in Mechanical Engineering from the University of Illinois Urbana-Champaign in 2005. His thesis research focused on high-speed visualizations of supersonic base flows. After graduation, he worked as a postdoctoral researcher in the Energy Systems division at Argonne National Laboratory, focusing on x-ray radiography of dense sprays. Dr. Kastengren now works as a physicist in the X-Ray Science Division at Argonne, overseeing the research program at the 7-BM x-ray beamline of the Advanced Photon Source. His research focuses on the use of time-resolved x-ray diagnostics to probe multiphase and combusting flows.

This seminar counts towards the ME 600 requirement.

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