Final Spring Seminar

Mechanical Engineering Graduate Student Organization

Wednesday, April 19 @11:00 AM 2004 Black Engineering

Alex Renner

3D Printer Software Aided Design

In 2016, the $6.063 billion Additive Manufacturing (AM) industry experienced its first significant downturn in Corporate Annual Growth Rate (CAGR), a "meagre" 17.4% [1]. However, there is no reason to panic, given the appropriate perspective. Three years ago, the industry experienced record growth of 34.9%, "fueled by the sales of $5,000 "personal" 3D printers" [2]. The next three years could be fueled by the sales of materials, software, and services for Desktop 3D printer users. There is evidence that this is the goal of software developers. Yet, it is unlikely that software developers will work together towards this goal in the most volatile and competitive segment of the industry. Methods to debunk the myth that users can import a 3D model and always print a good part are presented. These methods focus primarily on the Print Preview visualizations that continue to improve in all 3D printer software. Recommendations on how to realize the full potential of these open source or free software applications are provided. In addition, a simple but effective approach for organizing personnel and documentation is discussed. Case Studies are presented from interdisciplinary research efforts at the Virtual Reality Applications Center (VRAC) as well as undergraduate Mechanical Engineering student projects at Iowa State University. Best practices for laboratories with 3D printers are outlined. These best practices are supplemented with a collaboration schema for users and their interaction. Simulation software that contains features not available in Print Preview visualizations highlights new opportunities to fuel the sales of materials, software and services for Desktop 3D printers.

Ehsan Madadi-Kandjani

Application of the Fokker-Planck molecular mixing model to turbulent scalar mixing using moment methods

The evolution of a passive scalar for binary and ternary mixing can be approximated using the evolution equation of the univariate and bivariate probability density function (PDF). The PDF transport equation evolves with convection in physical space due to the mean velocity (macromixing), convection in physical space due to the velocity fluctuations (mesomixing), and by transport in composition space due to the molecular mixing (micromixing). The key element in PDF equation is the micromixing term, which is described using the Fokker-Planck (FP) molecular mixing model. The method of moments is being used to approximate the solution of the PDF. The direct numerical simulations (DNS) of Eswaran & Pope [V. Eswaran, S. B. Pope, Physics of Fluids, 31, 506 (1988)], and the amplitude mapping closure (AMC) of Pope [S. B. Pope, Theoretical and Computational Fluid Dynamics, 2, 255 (1991)] are taken as reference solutions to establish the accuracy of the FP model in the case of binary mixing. The DNS of Juneja & Pope [A. Juneja, S. B. Pope, Physics of Fluids 8, 2161 (1996)] are used to validate the results obtained for ternary mixing. Using scalar moments up to fourth order, the ability of the FP model to capture the evolution of the shape of the PDF, important in turbulent mixing problems, is demonstrated. The approach is then applied to the Multi-inlet vortex reactor (MIVR) to study the mixing characteristics such as mean mixture fraction and variance.

Food (Pizza) will be provided!

The seminar counts towards the ME 600 seminar requirement for ME graduate students