MCE 455: Advanced Fluid Dynamics- A Blended Course
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Computational Fluid Dynamics (CFD)

CFD simulation of a shock captured in a converging-diverging nozzle. Entrance Mach number $M_a = 0.5$. Nozzle throat is choked ($M_t = 1.0$)

Motivation
Reorganize course to better align goals, objectives, assignments and assessments. Rework weekly structure into a blended format with emphasis on improved scaffolding and student-centered activities.

Changes
- Built syllabus into a blended pedagogy including weekly face-2-face (in-class) and online (out-of-class) sessions, assignments and completed work submissions.
- New and reworked site tools to provide brief coverage of the CFD course, promote student social presence centered on weekly discussions, questions, etc., and permit online submittal of graphics, plots and white papers.

Background
- A revamped professional elective in mechanical engineering covering canonical problems in fluid flow including internal/external geometries, compressibility, shock capturing, heat transfer and turbulence.
- Students complete CFD simulations using a globally distributed software package. White papers are written for each CFD topic. Grades based on white papers and homework.
- Class size is typically 23-28 students.
- Teaching formats include in-class and online lecturing, students-centered activities, forum discussions, solo and team assignments, pub searches, etc.

Expectations
- Student clear understanding of a blended pedagogic opportunity as given by the reworked syllabus, weekly learning activities and site tools.
- Improved instructor-student and student-student social presence via the new site forums tool.
- Prompt face-2-face and online submission of completed work via a reworked site assignments tool.
- Improved scientific writing skills via weekly direct instruction and student-lead activities.
- Clear and concise simulation procedures, results, analysis and error assessment of CFD topics.