FINITE ELEMENT PROGRAMMING
TERM PROJECT

The course project selected will involve programming some aspect of the finite element method. Since this project represents a major portion of the course, it is important that you begin it as soon as possible. With this in mind, the following timetable has been set:

1. By Thursday, January 31, you should have had at least one consultation with Professor Shephard on the selection of a possible project topic, and have prepared a brief (one page) proposal for a term project which is due on that day.
2. On Thursday, February 28, a first project progress report (on the order of one page) is due.
3. On Monday March 25, a second project progress report (on the order of two pages) is due.
4. By Thursday, April 25, the final term project write-up is due.

Notes: Failure to adhere to the schedule and to follow the report formats will have an adverse effect on your grade. Progress reports should discuss the project. Do not turn in drafts of parts of the final report as a progress report. Progress reports are to summarize progress and issues associated with the project.

The project topic you choose should relate to your research activities. It is also possible to link this project to the project(s) you are doing in other courses so long as there is a clear indication of what is for which course and all instructors agree.

Team projects are encouraged. You just need to be sure the project proposal, progress reports and final report clearly identifies the activities of each team member.

The list below indicates some possible term project topic areas for which there is direct interest and there will be some level of interaction with SCOREC researchers working in this area. Do not hesitate to propose a different project that is of interest to you. You are strongly encouraged to discuss the possible projects with your thesis advisor.

1. 3D additive/subtractive manufacturing
2. Build on PUMI and the XGC1 codes from PPPL to develop a parallel coupled mesh-based and particle-in-cell (PIC) simulation capability.
3. Adaptive simulation workflows
4. Coupling of PIC and mesh based simulation codes.
5. Development of GPU based finite element operations.
6. Develop and implement error estimation procedures in MFEM or PHASTA.
7. Flow feature detection and feature-based mesh adaptation for CFD.
8. Continued development of EnGPar to do all dynamic load balancing operations.
9. Development of parallel mesh-to-mesh solution transfer methods.
10. Linkage of PHASTA, MFEM, Albany or some other code through the SCOREC parallel mesh and fields to perform UQ operations in DAKOTA.
11. Error estimation/indication and adaptivity for high-speed compressible flow problems including shocks .
12. Positivity preserving discontinuity capturing (for strong discontinuities/jumps)
13. Development of curved mesh adaptation procedures for high-order curved elements.
14. High-order stabilized finite element formulations (e.g., VMS, GLS, SUPG, etc.).