Nonplanar Geometry and CUBIT

Charles Williams
Brad Aagaard
Rowena Lohman
Matt Knepley
Geometry Representation in CUBIT

- CUBIT’s basic geometry engine is ACIS.
  - Geometry kernel used by many software packages (CAD, etc.).
- Surfaces are represented as NURBS surfaces.
  - Mathematical representation of a surface.
  - Surface intersections are easily computed.
- Surfaces can be defined within CUBIT, exported as ACIS files, and then used again later.
Steps for Creating Mesh with Nonplanar Surfaces

• Determine important structural features to include and decide on coordinate system.

• Create surfaces in CUBIT that will help define geometry and export them as NURBS surfaces.
  – Faults, other deformation sources, material boundaries.
  – Surface topography.

• Import surfaces into CUBIT.

• Add any additional geometric features that are needed for discretization.

• Create mesh with desired refinement.

• Create element blocks and node sets.

• Export mesh.
Possible Information Used To Create Surfaces

• Elevation contours (e.g., subduction zone interface).
  – examples/meshing/surface_nurbs/contours

• Gridded data (e.g., DEM).
  – examples/meshing/surface_nurbs/dem

• Triangulated surfaces (e.g., SCEC Community Fault Model).
  – examples/meshing/surface_nurbs/triangles
Elevation Contours

• Fill in any partial contours (usually unnecessary).
  – fill_contours.py

• Convert each contour to a spline curve that can be used by CUBIT.
  – cont2lines.py

• Read the curves in CUBIT and use them to create a skin surface.
DEM

• Create a text version of the DEM.
  – Example created with GMT grd2xyz.

• Create a set of intersecting curves to be read by CUBIT, with variable resolution if desired.
  – dem2lines.py

• Read the curves in CUBIT and then use them to create a net surface.
Triangulated Surface or Set of Points

• If surface is represented as a set of points, first create a triangulated surface in a format CUBIT can read (Facets).
  – mkfacets.sh
• Read the Facets file in CUBIT.
• Have CUBIT create a mapped mesh on the triangulated surface.
• Use the mapped mesh to create a net surface.