Nonplanar Geometry and CUBIT

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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.