CAD Model Idealization
Geometry Idealization

• Most real-world parts have many geometric details that make them difficult to analyze directly in FEA.
  – FEA model would require very small elements in many places.
  – FEA model would have too many DOF to solve in a reasonable amount of time with a reasonable amount of memory.

• Therefore FEA is almost always performed using a separate “Idealized” CAD model.
Idealization Approaches

• Create idealized CAD model from scratch.

• Create copy of detailed CAD model and create/remove features.

• Create associative copy of detailed CAD model and create/remove features. (Detailed CAD model is called the Master Model.)
Major Shape Idealizations

• Prismatic structure regions should be represented using beam elements
  – Create center-line/curve by:
    • Associative line/curve
      (e.g., center point-to-center point line construction)
    • Sketch line/curve
    • Edge on solid model
  – Beam cross-section must be defined from within FEA application (associativity more difficult)
Major Shape Idealizations

• Thin wall regions should be represented using shell elements
  – Create surface by:
    • Associative surface (e.g., midsurface or offset surface construction)
    • Sheet body
    • Face on solid model

  – Thickness must be defined from within FEA application (associativity is possible)
Minor Detail Idealization

- Automatic Feature Removal Tools
  - Remove holes smaller than given radius.
  - Remove blends smaller than given radius.

Images from Siemens PLM NX Online Documentation.
Minor Detail Idealization

- Manual Feature Idealization
  1. Search for “tiny” objects (faces with dimension or angle smaller than given size)
  2. “Defeature” (removes selected faces; remaining faces merge together)

Images from Siemens PLM NX Online Documentation.
Minor Detail Idealization

3. Create point or line/curve to replace detailed feature (if required to allow applying boundary conditions)

4. Split face at line/curve to create edge in solid (edge replaces curve)
Minor Detail Idealization

5. Merge small faces into large faces (becomes one large face)