Report Outline

Monday, May 28, 2018

8:32 PM

This outline is how the current report lies.

* **Background**
  + A quick discussion covering how VTMS is from AFRL and has interpenetrations. This section also discusses the solution of shrinking tow cross-sections and how this overly affects material properties
* **Approach**
  + Quick discussion about VTMS and DFMA as realistic tow surface geometry generation software.
  + ***Interpenetrations***
    - Introduces the idea of surface interpenetrations with a figure. Meant to briefly show what we mean by interpenetration of tows (by surfaces)
  + ***Identification of Interpenetrations***
    - Discussion between the two data types used during the detection and resolution of interpenetrations
      * Discrete mesh-type representation with nodes and surface elements (standard tow and clipped tow geometries)
      * NURBS type representation (not discussed in detail)
    - How VTMS detects interpenetrations using a ray-intersection algorithm
    - Improvements to VTMS' method using a searching algorithm to determine a nodes nearest surface element neighbor on an opposing node
    - Using NURBS library to determine interpenetration regions via boundary curves returned from SISL library
    - Discussing that a translation of the data for use in Paraview was developed for boundary curves and NURBS surfaces
      * Comparison of VTMS data and NURBS surface
  + ***Resolution of Interpenetrations***
    - Creation of planar "contact" region to ensure surfaces along this region do not intersect but share a common surface
      * Created from the cross product of the tow path directions (ensures plane is normal to both tows) and the average of all interpenetrating nodes in region
      * Trouble enforcing compatibility along surface
    - Creating node pairs (does not necessarily mean that one node has a unique pair) and find the middle location between the two to move both nodes to
      * This insures compatibility between surface tow nodes
    - Use boundary curves of interpenetration regions to identify elements that interpenetrate an opposing tow
      * We use the boundary curve to create nodes where the curve intersects elements for each tow
        + Results in a curve that is compatible with both surfaces along its path
      * Use boundary curve and elements to create sub-meshed elements that we replace the original elements with
        + This results in surface meshes that are compatible between tows
      * Can use these new meshes for different operations (such as boolean, surface contact, median surface, etc)