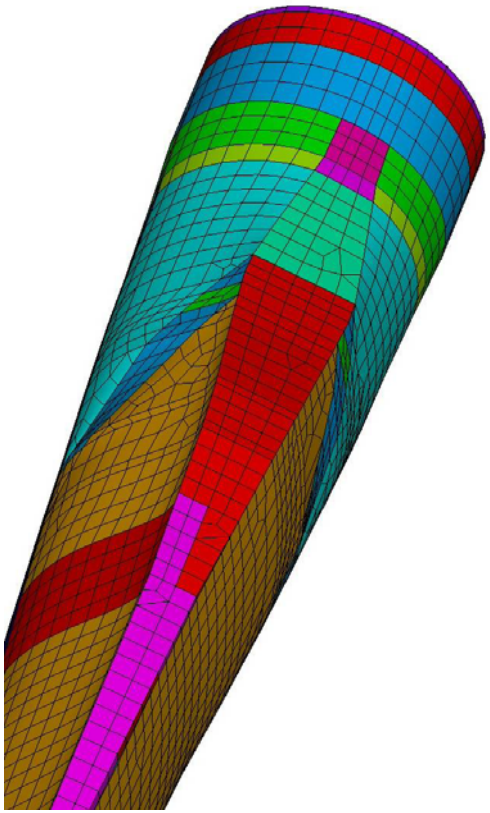
NuMAD
Blade Structural Analysis



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Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy under contract DE-AC04-94AL85000.

Motivation

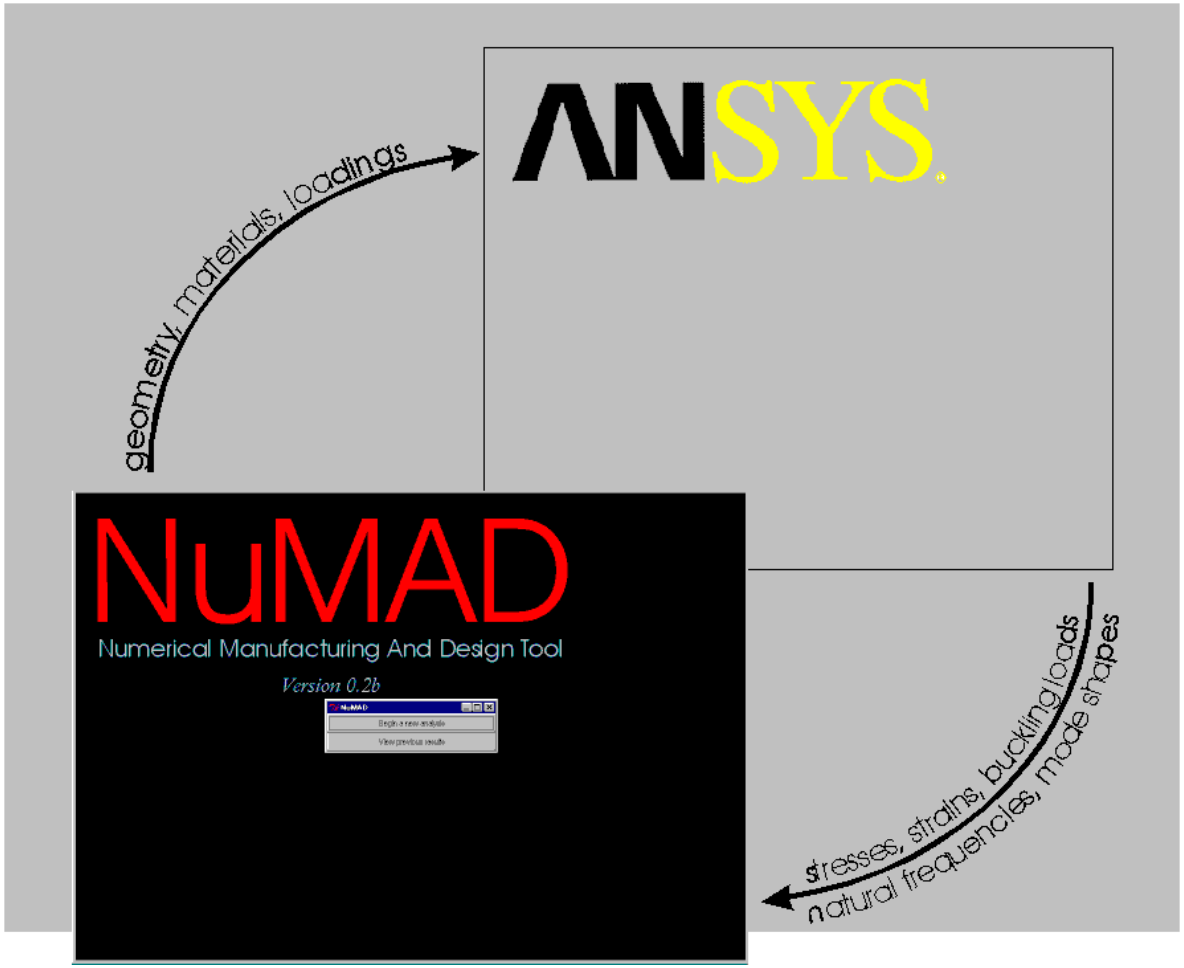
Assist utilization of 3-D Finite Element Analysis in addition to beam models (section analysis)

Significantly decrease model generation time for 3-D, FE models of wind turbine blades

Front-End Approach

Create stand-alone front-end to commercially available package.

Allows for ease-of-use combined with power of commercial software.



What is NuMAD?

Stand-alone, GUI pre-processor for ANSYS® finite element analysis software

Tailored to design and analyze wind turbine blade structures

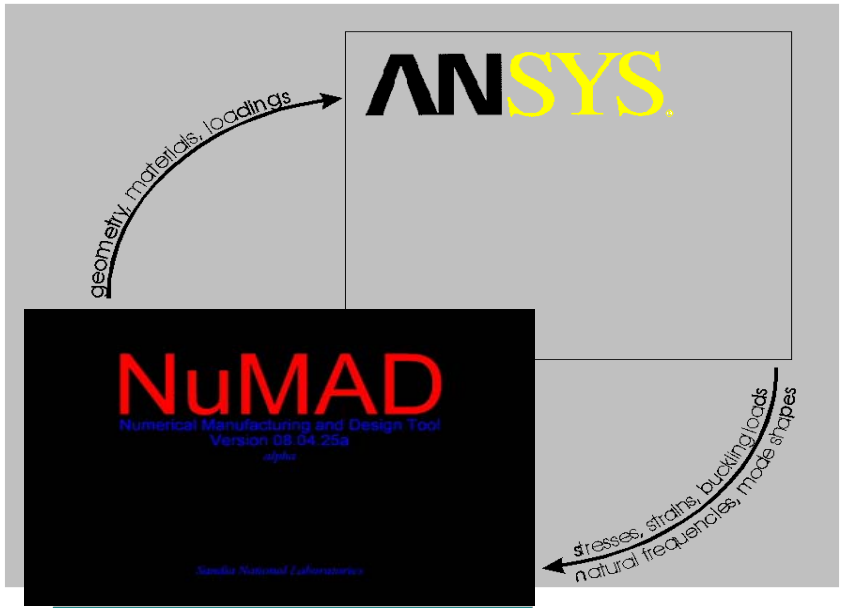
Enables users to quickly and easily create a three-dimensional model and perform structural analyses

Produces ANSYS batch input file or ANSYS database (*.db)

General FEA background needed for proper use

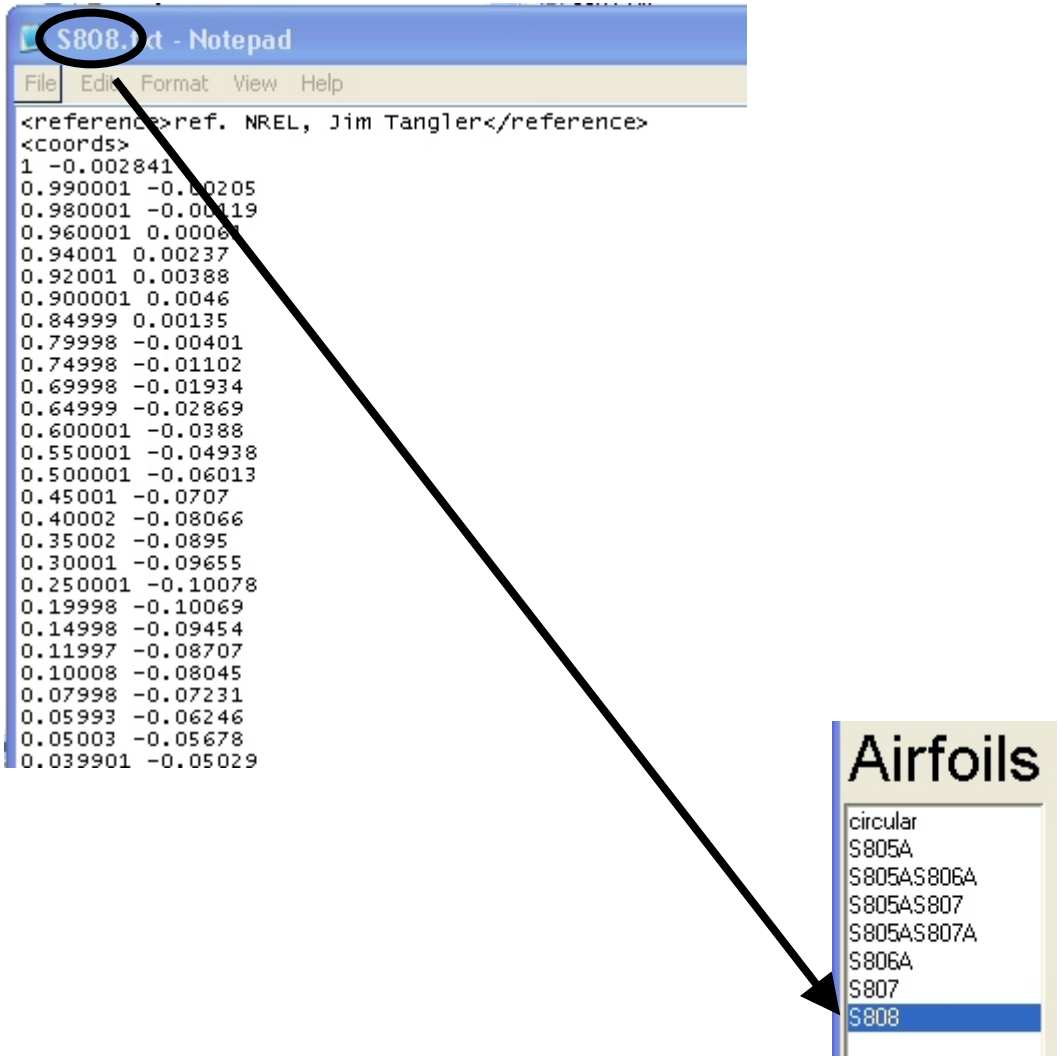
Flexibility/expandability

- materials database
- airfoils database



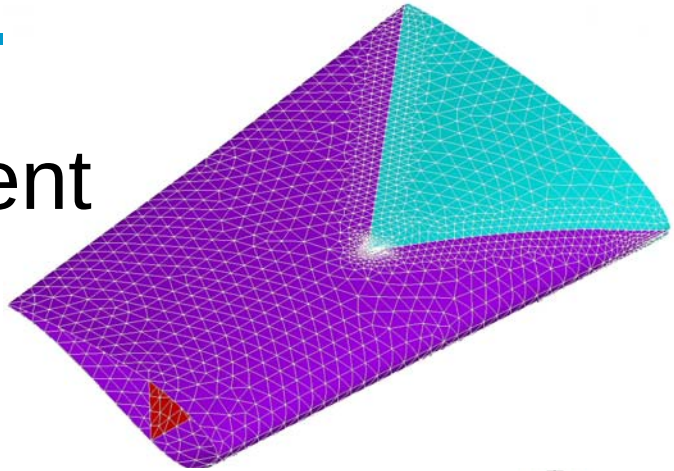
Airfoils Database

The airfoils database may be expanded by simply adding a text file containing the coordinate pairs defining the profile.



Major Revision to Code

Sep 2008



Airfoil specification-independent

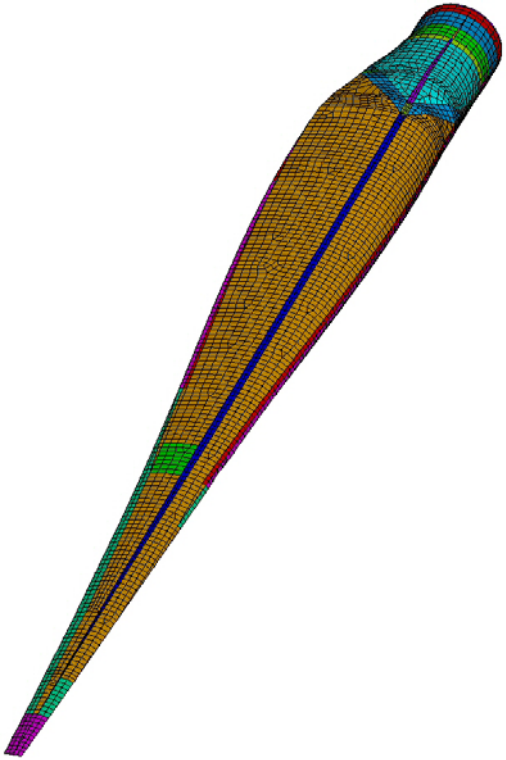
- skin material definition
- shear web placement

Triangular areas in blade skin

Free meshing / Meshing control

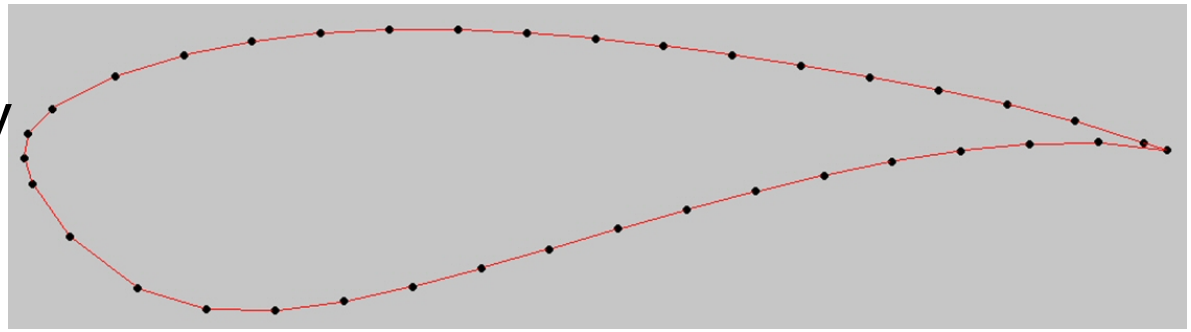
Flatback capability

Multiple element formulations



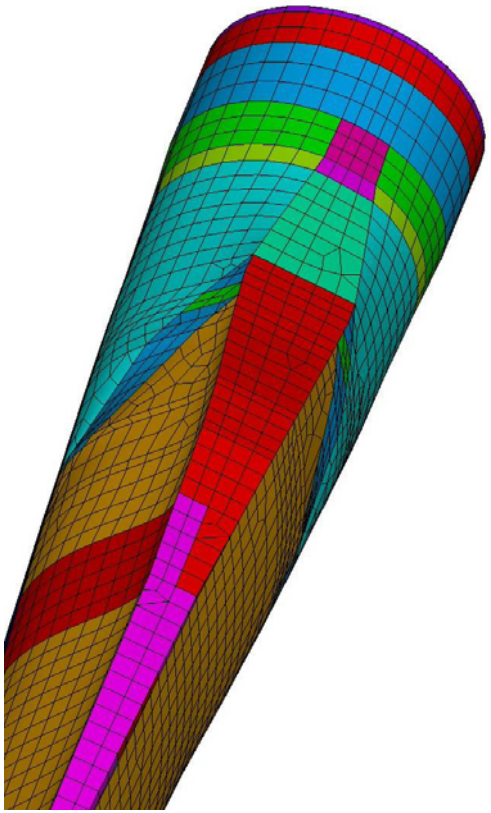
Airfoil Definition Independent

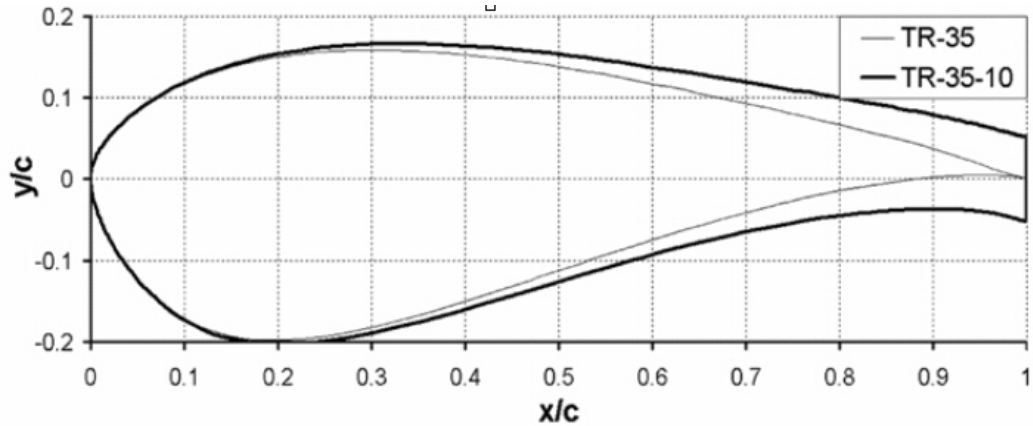
Skin materials and shear webs could only begin and end at a point defining the airfoil



No limitations on skin material definition or shear web placement

Flatback Capability

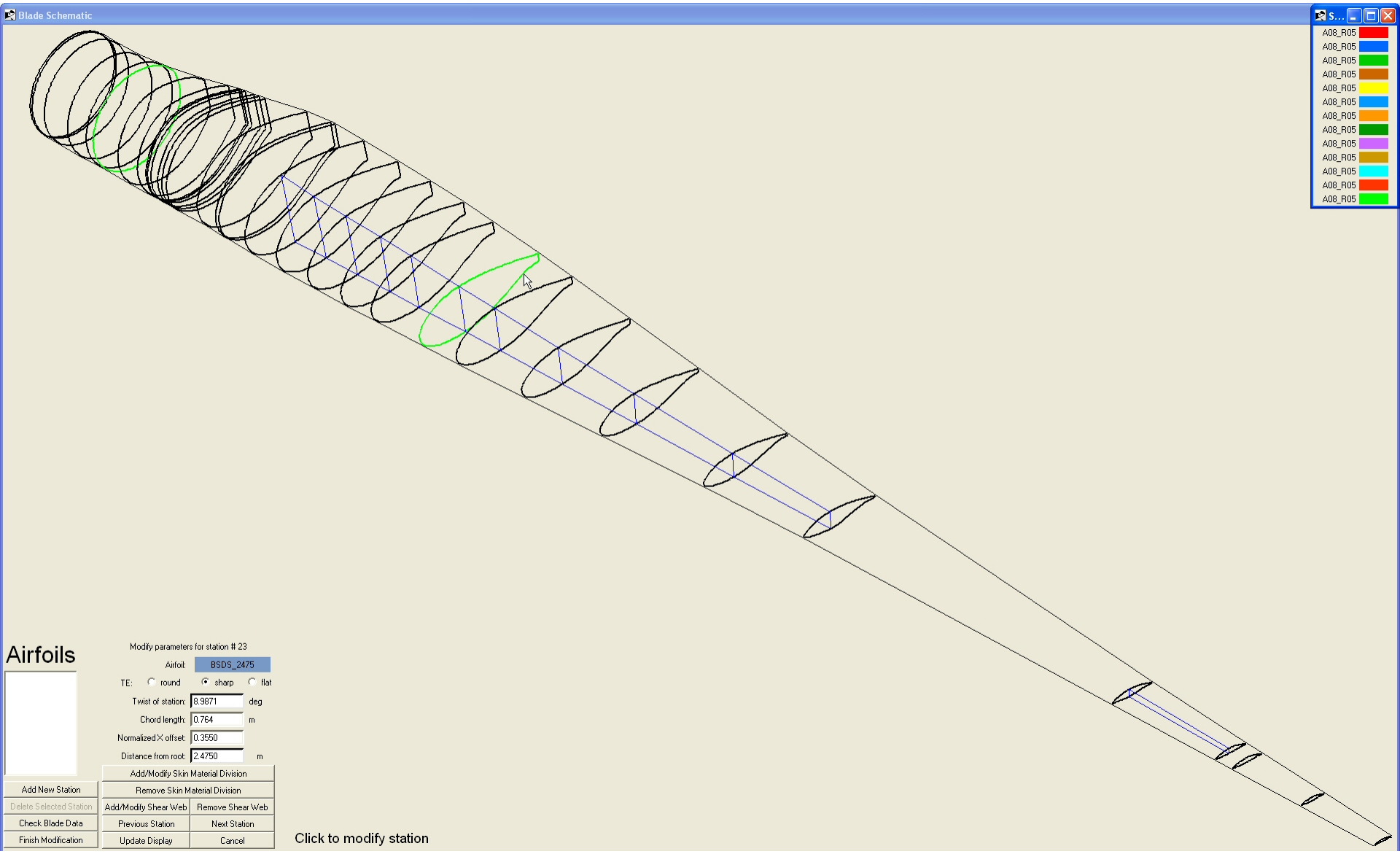




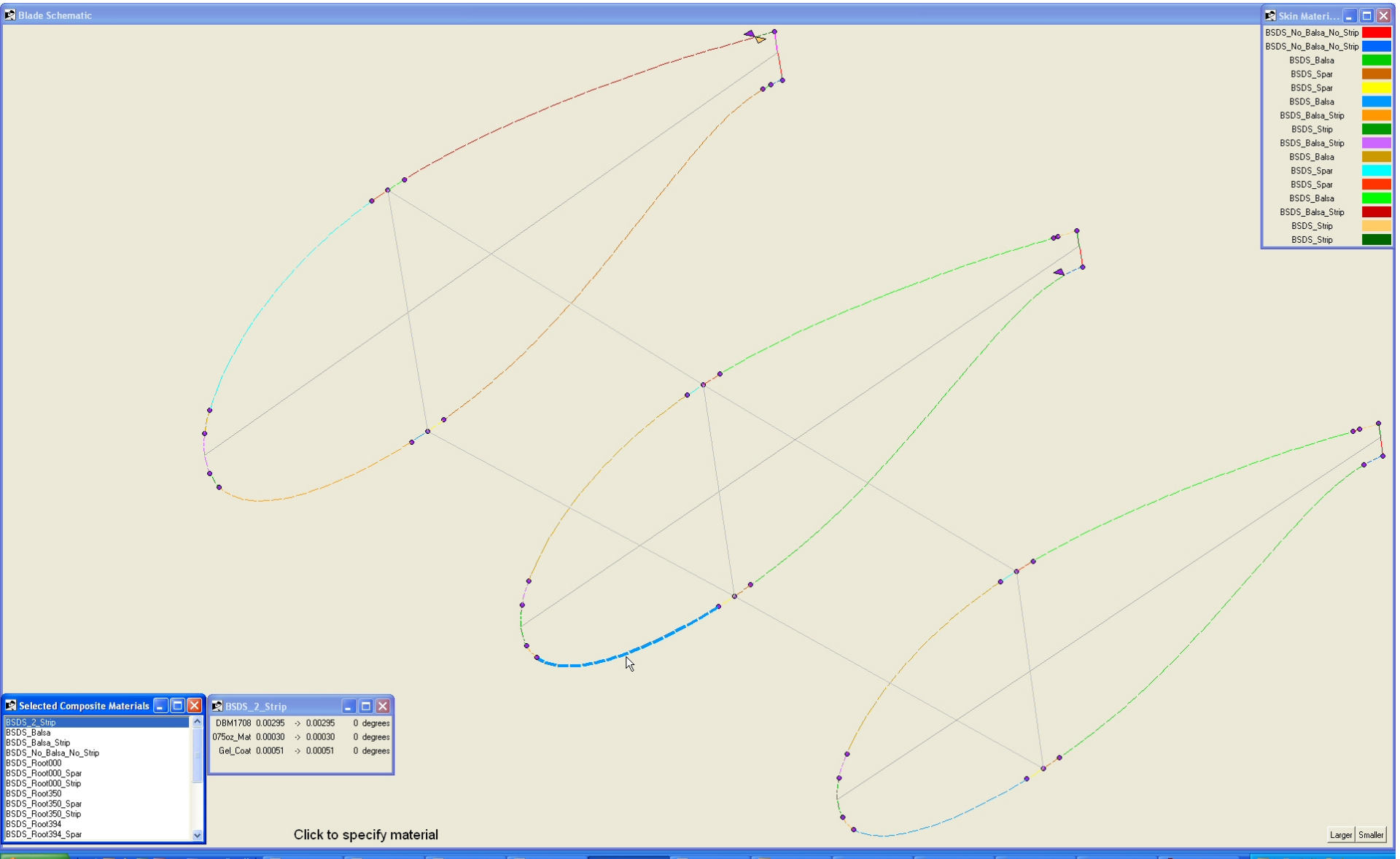
NuMAD analyzes points near trailing edge to determine if airfoil is a flatback

If so, chordwise splining is modified to appropriately handle flatback

Interface (NuMAD2008)



Interface (NuMAD2008)



Demo

NuMAD

Materials and airfoil definitions backward compatible

Model definitions not backward compatible

User Manual

Temporary scale-back of functionality

- Performing analysis automatically
- Beam Property Extraction

Future Work

- Add back previous functionality
  - Performing analysis automatically
  - Beam Property Extraction
- PreComp input
- Add layered brick element

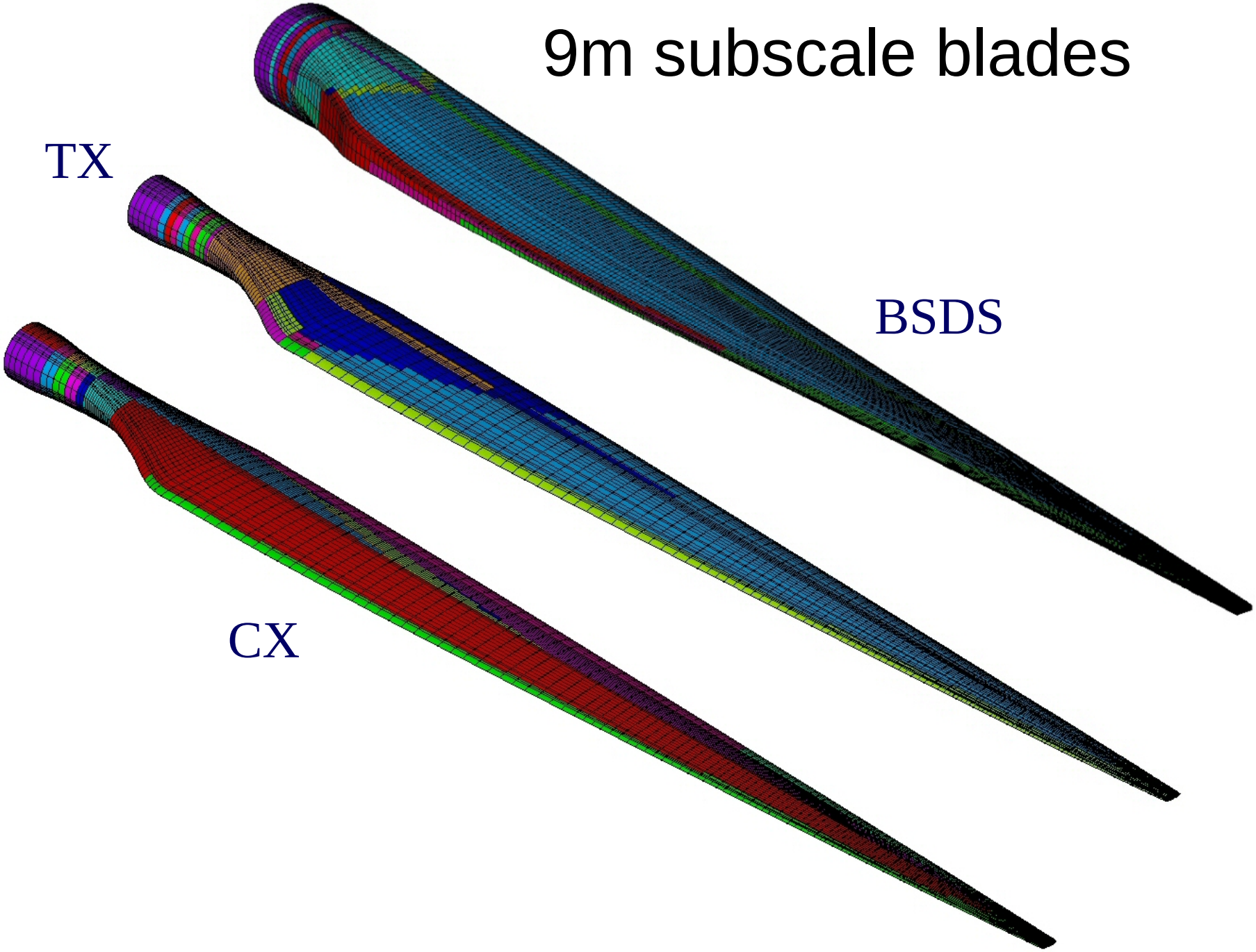
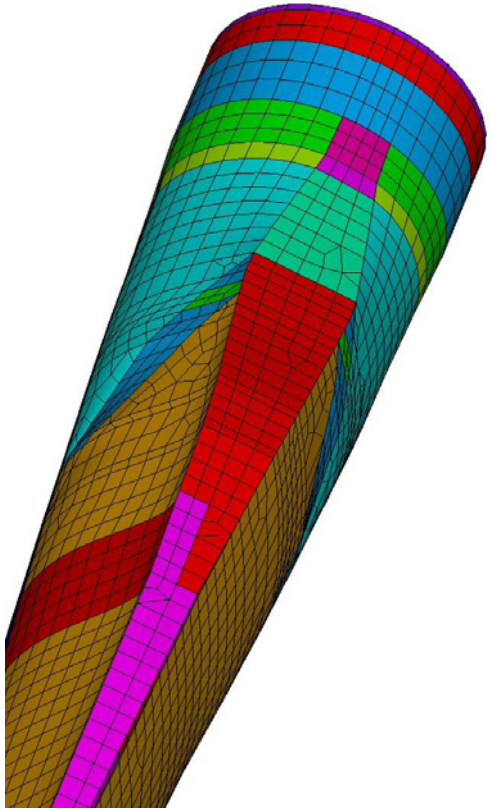
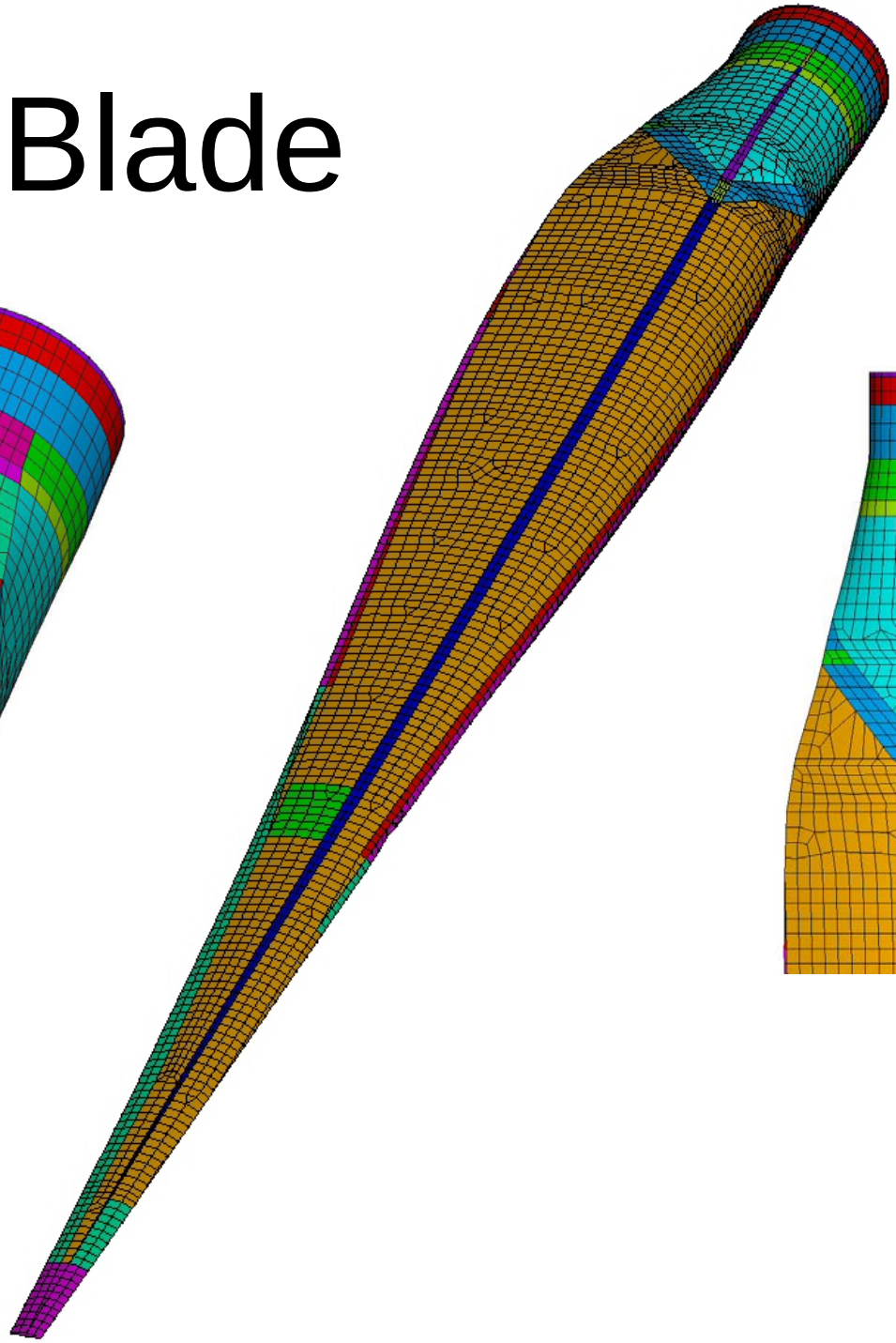
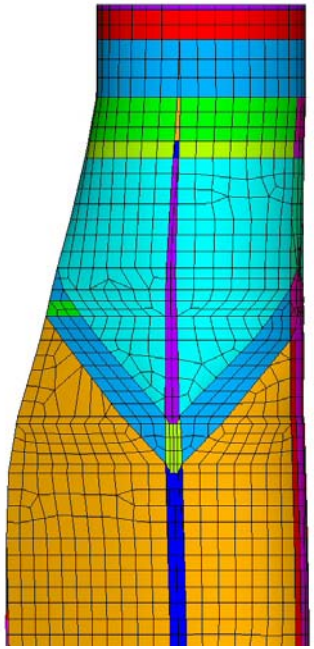
Obtain Code?

www.sandia.gov/wind/NuMAD.htm

Thank You

Supporting Material

9m subscale blades



BSDS Blade