Wind Energy Research at Iowa State University

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Overview

• The Wind Energy Manufacturing Laboratory (WEMIL)

• The Advanced Manufacturing Innovation Initiative (AMII)

• Other Wind Energy Efforts at ISU

• Wind Blade Manufacturing Challenges
AMII Research Projects at ISU

1. Non-Destructive Evaluation of thick composite for wind blades
2. Dimensional Variability Reduction during blade component fabrication and assembly
3. Automated Fabric Layup for broad panel fiberglass

1: Non-Contact, Air Coupled Ultrasound

Detection of manufactured waves on a trailing edge of a mega-watt class turbine blade using non-contact air-coupled ultrasound

2: Dimensional analysis of production wind blades, via laser scanning and laser tracking

Combinations of dense point cloud laser scanning coupled with laser tracker measurements in order to map dimensional variability during blade production
New laser scanning method to identify individual tows of UD fabric as opposed to conventional point clouds; enables more advanced analysis of out-of-plane waviness

New process planning methods to map out automated fabric manipulations that can re-distribute shear deformation of the fabric to enable wave-free layups

Automated manufacturing of root preforms in the ISU lab (50% scale from a ~40 meter blade)

Fabric manipulation device developed which allows for wave-free UD fabric layup about extreme direction changes
Other Wind Energy Efforts at Iowa State University

- **Wind Energy Initiative**
  - 1 of 3 initiatives funded by College of Engineering
  - $500,000 over 3 years to pursue funding (but not to do research)
  - Establish a Wind Energy Institute
  - Over 40 investigators collaborating at ISU as well as other institutions
  - External partners

- **NSF IGERT**
  - 30 PhD students over 5 year period, beginning 1/12
  - New PhD program: Wind Energy Science, Engineering & Policy
  - Includes (3 month) international and industrial components

- **NSF REU**
  - 3 years; 10 students each year for 10-week program
  - Individual & group projects, short course, lectures, tours

- **NSF Grant**
  - $300K
  - “Surface Wind Energy Resources and Wake Interferences”

- **DOE 3.1 Grant (New)**
  - ~$4.4M (expected)
  - Title: “Innovative Offshore Vertical-Axis Wind Turbine Rotors”
  - Partners: Sandia, TPI, ISU, Umaine, TUDelft
Challenges in Blade Manufacturing

• Much of the composite manufacturing state-of-the-art is too expensive for blades (aerospace solutions are not always feasible/cost-effective)

• Glass composites for blades use broad fabric panels which do not “want” to go into a 3D mold (this is not Automated Tape Layup, therefore… touch labor required)

• Automation solutions must utilize “reduced” axes solutions for multi-axis placement problems (complex manipulation with simple automation = cheaper and easier)
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