Bottom Fixed Platform Dynamics Models Assessing Surface Ice Interaction for Transitional Depth Structures in the Great Lakes

Dale G. Karr
University of Michigan

NREL/DOE Workshop, AWEA OFFSHORE WINDPOWER 2012
Research Project Objective

- Develop an ice module for FAST.
- Include 6 ice/structure models, based on ice failure mode and dynamic structural response.
- Useful for a general ice/structure scenario, not restricted to conditions in the Great Lakes.

Ice Model 1

Quasi-static ice/structure interaction
- Low ice speed, stiff structure
- Loading frequency much smaller than that of the structure
- Prescribed ice force: failure mode: creep, buckling
Ice Models

- **Ice Model 2 - Dynamic ice/structure interaction**
  - Intermediate ice speed, loading frequency comparable to the structure
  - Structure response coupled with ice force; failure modes are creep and crushing

- **Ice Model 3 - Dynamic ice/structure interaction**
  - Intermediate ice speed, loading frequency comparable to the structure
  - Structure response coupled with ice force; failure modes are creep and crushing
Ice Models

- **Ice Model 4 - Multiple failure zone**
  - Imperfect contact, small area of high-pressure contact
  - Local failure mode: crushing

- **Ice Model 5 - Ice bending**
  - Sloping structure
  - Ice failure mode: tensile fracture,
  - lower tensile strength

- **Ice Model 6 - Ice floe impact**
  - Sudden increase in forces
  - Transient, high amplitude vibrations
  - Limiting factor: splitting failure
Acknowledgement:

US Department of Energy
Wind Energy Program