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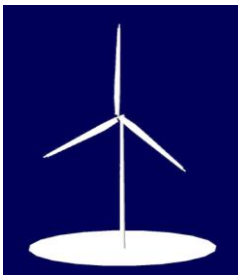
Description of Model Data for SNL13.2-00-Land: A 13.2 MW Land-based Turbine Model with SNL100-00 Blades



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Introduction

This document provides a description of model files for the SNL13.2-00-Land Turbine model with SNL100-00 blades [1]. The codes associated with these files are also described (e.g. code version and usage). This document is intended to provide only a brief description of the turbine model files and the files required to produce the turbine model data. Additional code usage information can be found in the code user manuals.

The SNL13.2-00-Land turbine model is based on the NREL 5MW model [2] as the turbine parameters and tower properties; for example, were scaled up to 13.2 MW. This provided a turbine platform for simulation of 100-meter blade concepts. However, in addition to upscaling turbine components, two significant changes/modifications have been made: (1) the blade models included in this package correspond to the SNL 100-meter Baseline design (SNL100-00) and (2) a modified version of the FAST/AeroDyn code executable is provided to enable variation of control parameters (e.g. rated power, pitch & VS control parameters) without the need to re-compile the FAST source code and/or controller.

This model package is made available so that large blade studies associated with the SNL100-00 blade can be performed and evaluated using IEC design load conditions. In addition to blade studies, turbine and turbine control studies are also possible at 13.2 MW scale with the model.

A separate package of files is available for the detailed blade SNL100-00 blade model (SNL NuMAD format and ANSYS format) [3].

Description of Turbine Model File Package

The turbine model file package for SNL13.2-00-Land includes the set of files required for the FAST/AeroDyn code [4]. As FAST requires blade mode shapes, Modes [5] was used to compute the blade modes for both parked and rotating conditions. Transient inflow conditions were produced using IECWind [6]. Table 1 provides a summary of the codes and code versions.

Table 1. Codes Summary for SNL13.2-00-Land Turbine Modeling and Simulation

Code	Code Version	Description
FAST/AeroDyn	V6.01 (modified to include new control and power parameters)	Turbine aeroelastic simulation code
Modes	V2.2	Computes natural frequencies and mode shapes of rotating blade for input to FAST
IECWind	V5.10	Computes transient inflow conditions according to IEC standards for input to FAST

Table 2 provides a summary of the files included in the turbine model file package. The package includes the standard set of FAST files, with the exception of modifications required in the control parameters. The Modes input and output files are included along with the IECWind input file. For more information on FAST please see Reference 7.

Table 2. SNL13.2-00-Land Turbine Files Summary

Filename	Code	Usage	Description
FAST_bladed_dll.exe	FAST/AeroDyn	Executable	Re-compiled with 13.2 MW control variables
DISCON.dll	FAST/AeroDyn	Controller that reads text input file (localvars.txt)	Re-compiled controller based on NREL 5MW controller
localvars.txt	FAST/AeroDyn	Text file containing turbine control parameters	Implemented so that turbine control parameters can be varied without requiring re-compilation
SNL13pt2-00-Land.fst	FAST/AeroDyn	FAST input file	Contains turbine and simulation parameters
SNL13pt2-00-Land_AeroDyn.ipt	FAST/AeroDyn	AeroDyn input file	Contains aerodynamic parameters
"AeroData" Folder	FAST/AeroDyn	Folder containing airfoil performance information	Set of files for various airfoils
SNL100-00_Blade_Parked.dat	FAST/AeroDyn	Blade input file (Parked, 0 RPM)	Contains blade span-wise properties from PreComp and mode shapes from Modes
SNL100-00_Blade_7pt44RPM.dat	FAST/AeroDyn	Blade input file (rotating, 7.44 RPM)	Contains blade span-wise properties from PreComp and mode shapes from Modes
SNL13pt2-00-Land_Tower.dat	FAST/AeroDyn	Tower input file	Contains tower span-wise properties
SNL13pt2-00-Land_Linear.dat	FAST/AeroDyn	Linearization option	Produce linearized model
SNL13pt2-00-Land_ADAMSSpecific.dat	FAST/AeroDyn	MSC.ADAMS option	Produce MSC.ADAMS model
ECD-R.wnd	FAST/AeroDyn	Required by *SNL13pt2-00-Land_AeroDyn.ipt*	Produced by IECWind
SNL_13p2MW_Parked.inp *SNL_13p2MW_7pt44RPM.inp*	Modes	Modes input files	For parked and rated RPM cases
SNL_13p2MW_Parked.mod *SNL_13p2MW_7pt44RPM.mod*	Modes	Modes output files	For parked and rated RPM cases
IEC.ipt	IECWind	Input file for IECWind	Describes desired inflow conditions for generation

Future Document Release

In the future, this document may be revised or updated to include; for example, sample FAST results or turbine characteristics.

References

[1] Griffith, D.T. and Ashwill, T.D., “The Sandia 100-meter All-glass Baseline Wind Turbine Blade: SNL100-00,” Sandia National Laboratories Technical Report, SAND2011-3779, June 2011.

[2] Jonkman, J., S. Butterfield, W. Musial, and G. Scott, "Definition of a 5-MW Reference Wind Turbine for Offshore System Development," NREL/TP-500-38060, Golden, CO: National Renewable Energy Laboratory, February 2009.

[3] Griffith, D.T. and Resor, B.R., “Description of Model Data for SNL100-00: The Sandia 100-meter All-glass Baseline Wind Turbine Blade,” Sandia National Laboratories Technical Report, SAND2011-9309P, December 2011.

[4] NWTC Design Codes (FAST by Jason Jonkman). http://wind.nrel.gov/designcodes/simulators/fast/. Last modified 12-August-2005; accessed 12-August-2005.

[5] *NWTC Design Codes (Modes by Marshall Buhl)*. http://wind.nrel.gov/designcodes/preprocessors/modes/. Last modified 26-May-2005; accessed 26-May-2005.

[6] NWTC Design Codes (IECWind by Dr. David J. Laino). http://wind.nrel.gov/designcodes/preprocessors/iecwind/. Last modified 01-September-2005; accessed 01-September-2005.

[7] Jonkman, J. M.; Buhl Jr., M. L. "FAST User's Guide," NREL/EL-500-29798. Golden, Colorado: National Renewable Energy Laboratory, 2005.

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