



HAWC2 – Course

Anders Yde (AY)

Anders Melchior Hansen (AM)

Torben J. Larsen (TJ)

Taeseong Kim (TK)

Lars Christian Henriksen (LC)

Peter Bjørn Andersen (PB)

Morten Hartvig Hansen (MH)

$$f(x+\Delta x) = \sum_{n=0}^{\infty} \frac{(\Delta x)^n}{n!} f^{(n)}(x)$$

$$\int_a^b \Theta^{\sqrt{17}} + \Omega \int \delta e^{in} = \{2.7182818284 \dots\}$$

$$\Sigma!$$

Risø DTU

Nationallaboratoriet for Bæredygtig Energi



Time Schedule

	Morning	Afternoon
Monday, 12/3	<ul style="list-style-type: none"> Introduction (AY,TJ) Structural modeling and implementation in HAWC2 (AY) 	<ul style="list-style-type: none"> Wind condition, modeling and implementation in HAWC2 (TJ) Aerodynamic modeling and implementation in HAWC2 (PB)
Tuesday, 13/3	<ul style="list-style-type: none"> Hydrodynamics and wave kinematics module (TJ) Floating structures and mooring lines (AM) 	<ul style="list-style-type: none"> controller implementation and tuning (LH) IEC Load cases and Autogeneration of inputfiles (AY, TK) HAWCstab2 (MH)
Wednesday, 14/3	<ul style="list-style-type: none"> Wake loads (TJ) 	<ul style="list-style-type: none"> Post processing tools (TK) VAWT in hawc2 (TJ)



What is the HAWC2 code?

A tool for simulation of wind turbine response in time domain with following properties:

- Normal onshore with 1 or multiple blades
- Pitch and (active) stall controlled wind turbines
- Guyed support structures
- Offshore turbines on monopoles, tripods or jackets
- Floating turbines with mooring lines
- Multiple rotors in one simulation
- Structural core based on a multibody formulation that can handle multiple degrees of freedom (like blade torsion)
- Detailed aerodynamic model based on BEM that includes:
 - Three dynamic stall models: Stig Øye model, a modified Beddoes-leishmann model and model for ATEF (Active Trailing Edge Flaps)
 - Skew inflow model
 - Shear effects on the induction
 - Dynamic inflow model
 - Tiploss



- Hydrodynamic model based on Morrison's equation
- Water Kinematics that includes:
 - Currents
 - Linear airy waves
 - Irregular airy waves
 - Deterministic irregular waves
 - Stream function waves
- Wind, turbulence and wake models:
 - Build-in Mann turbulence generator (Fully coherent 3D-turbulence)
 - Able to read Veers turbulence model (used in FLEX5)
 - Dynamic wake meandering model for turbines in wakes
- Control interface preformed through DLL's (Dynamic Link Library)
- Default controller provided with a pitchregulated variable speed controller
- Soil module consisting of a set of spring-damper forces attached to a main body.
- Excel spreadsheet macros for automatic input file creation – coupled to a distributed computing tool.
- Time domain simulations is the primary output, however eigenvalues can be calculated at stand still.



Program structure

Name	Date modified	Type	Size
animation	30-09-2011 08:20	File folder	
control	30-09-2011 08:20	File folder	
data	30-09-2011 08:20	File folder	
eigenfrq	25-08-2011 11:22	File folder	
htc	30-09-2011 08:20	File folder	
log	30-09-2011 08:20	File folder	
res	30-09-2011 08:20	File folder	
turb	30-09-2011 08:20	File folder	
manual_version_4-0.pdf	12-07-2011 12:39	Adobe Acrobat D...	1.053 KB
Animation.exe	21-09-2008 09:54	Application	1.825 KB
get_mac_adresses.exe	27-09-2010 11:01	Application	364 KB
hawc2MB.exe	17-05-2011 10:52	Application	3.244 KB
WINDAP.exe	16-11-2006 16:03	Application	1.208 KB
ainslie_15.dll	04-12-2009 23:47	DLL File	32 KB
DFORMD.DLL	20-06-2001 03:11	DLL File	446 KB
DFORMDD.DLL	20-06-2001 03:11	DLL File	446 KB
DFORRT.DLL	20-06-2001 03:10	DLL File	440 KB
DFORTD.DLL	20-06-2001 03:10	DLL File	440 KB
licence_manager.dll	27-09-2010 11:18	DLL File	424 KB
Mann.dll	10-06-2009 15:30	DLL File	97 KB
MSVCRTD.DLL	07-03-2000 00:00	DLL File	425 KB
wkin_dll.dll	07-05-2009 14:48	DLL File	144 KB
Hawc2Bat.BAT	07-04-2011 13:57	Windows Batch File	1 KB
start_dos.bat	30-09-2010 17:39	Windows Batch File	1 KB

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License manager

- When properly installed the HAWC2 answer to execution should be like this:

```
C:\WINDOWS\system32\cmd.exe
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.

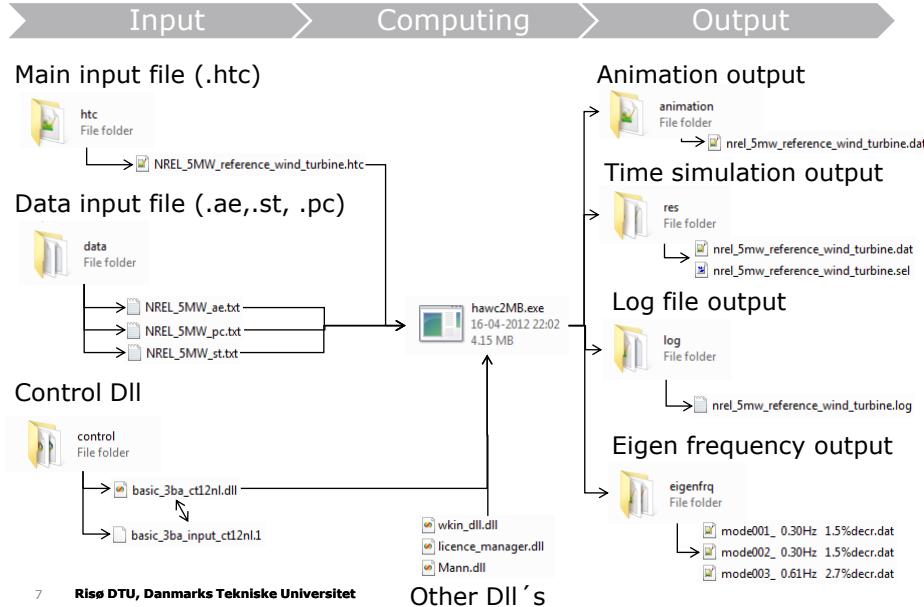
c:\Risoe\Undervisning\HAWC2_course_2009\hawc2_model>hawc2MB.exe
HAWC2MB version: HAWC2MB 8.2
License verified - OK
Wrong number of arguments: Usage: <exe file> <htc file>
c:\Risoe\Undervisning\HAWC2_course_2009\hawc2_model>
```

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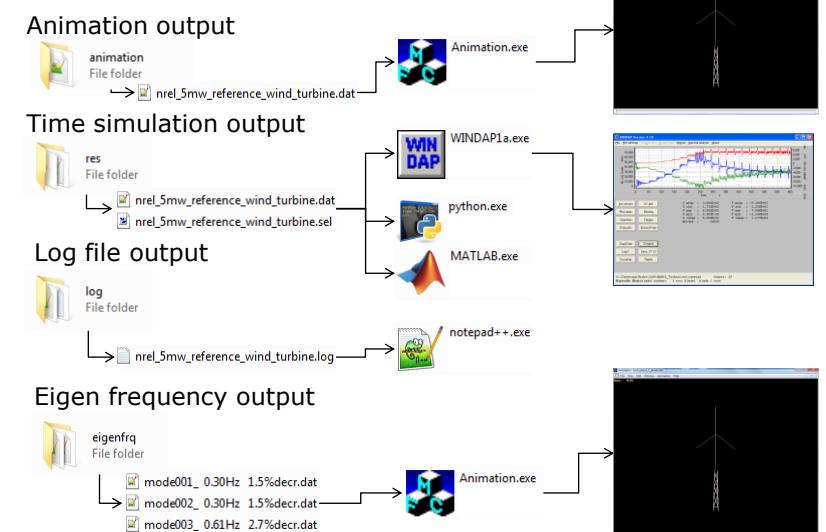
Anders Yde 03-oct-2011



Program structure



Postprocessing





Working with text based input

Use a editor with useful features:

e.g. notepad ++

Main folder -> tools -> Notepad++6.2-> npp.6.2.Installer.exe

Install hawc2 language for notepad ++:

- Get a better overview of your input file
- Main folder -> tools -> HAWC2 language for Notepad++ -> follow instructions

Install plugins for notepad++:

- Useful tool like compare and monitor documents
- Main folder -> tools -> Plugins for Notepad++ -> follow instructions