Verification of coupling interface between an aeroelastic code and a time domain Rankine solver for completing structural analysis of floating wind turbine foundation design

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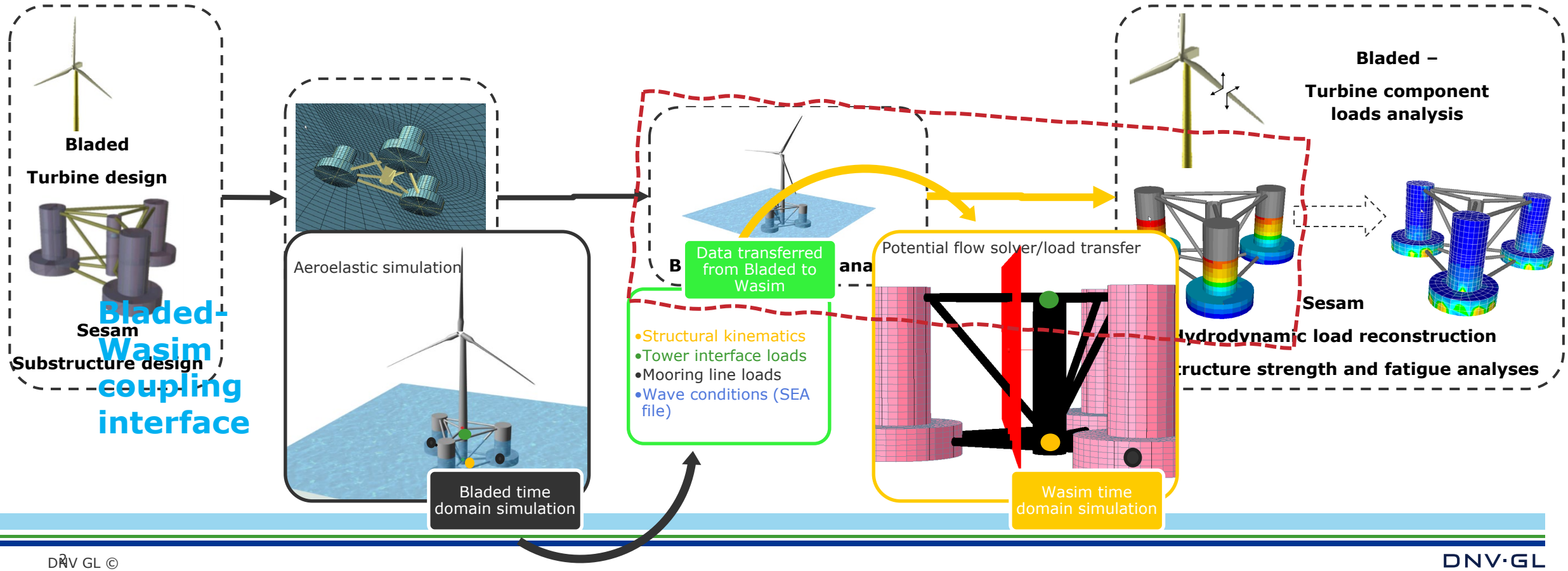
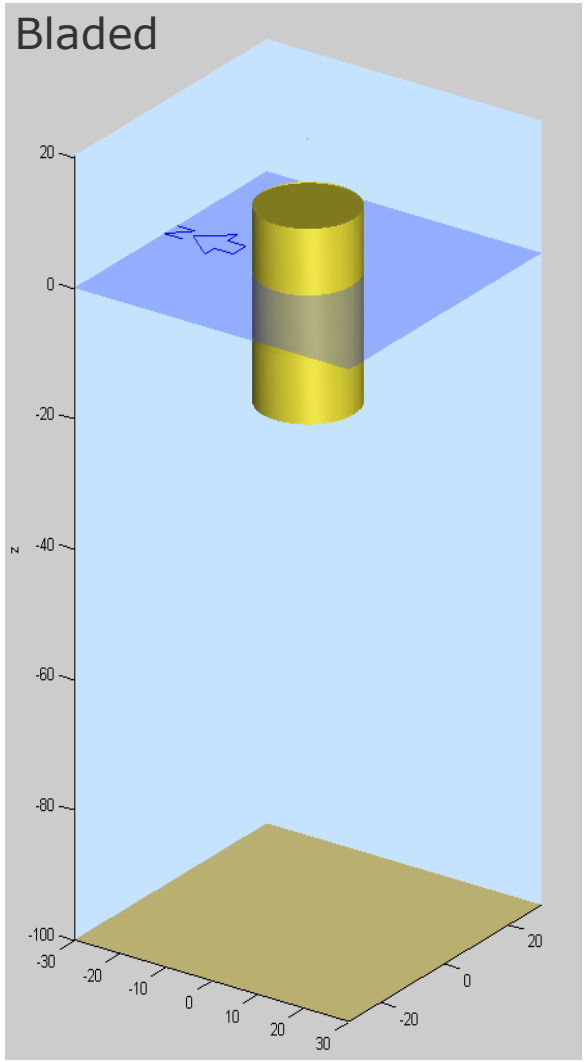
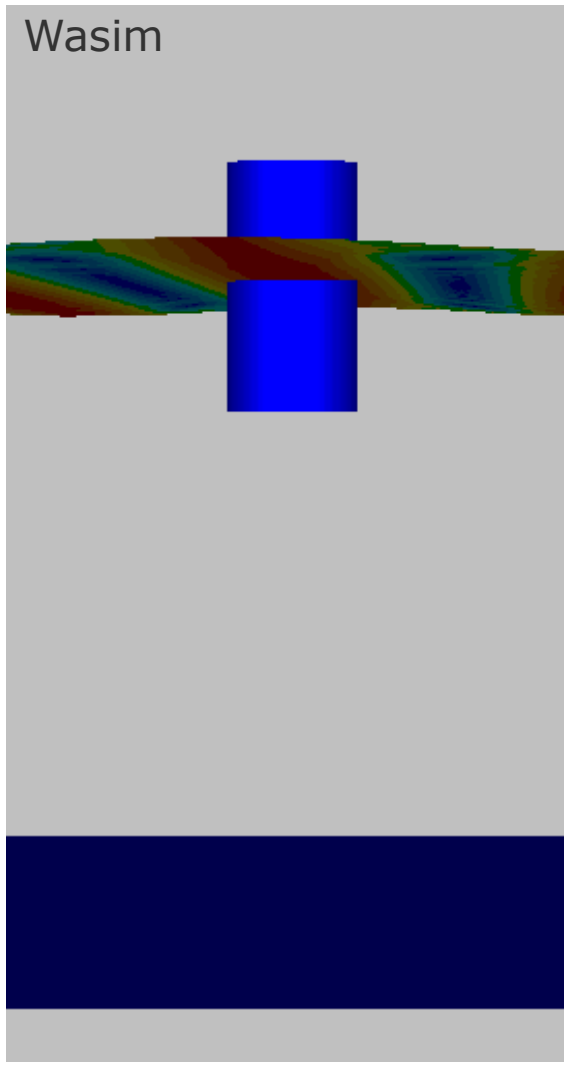
Poster No.: 24

DNV GL floating OWT workflows



Verification study-model definition





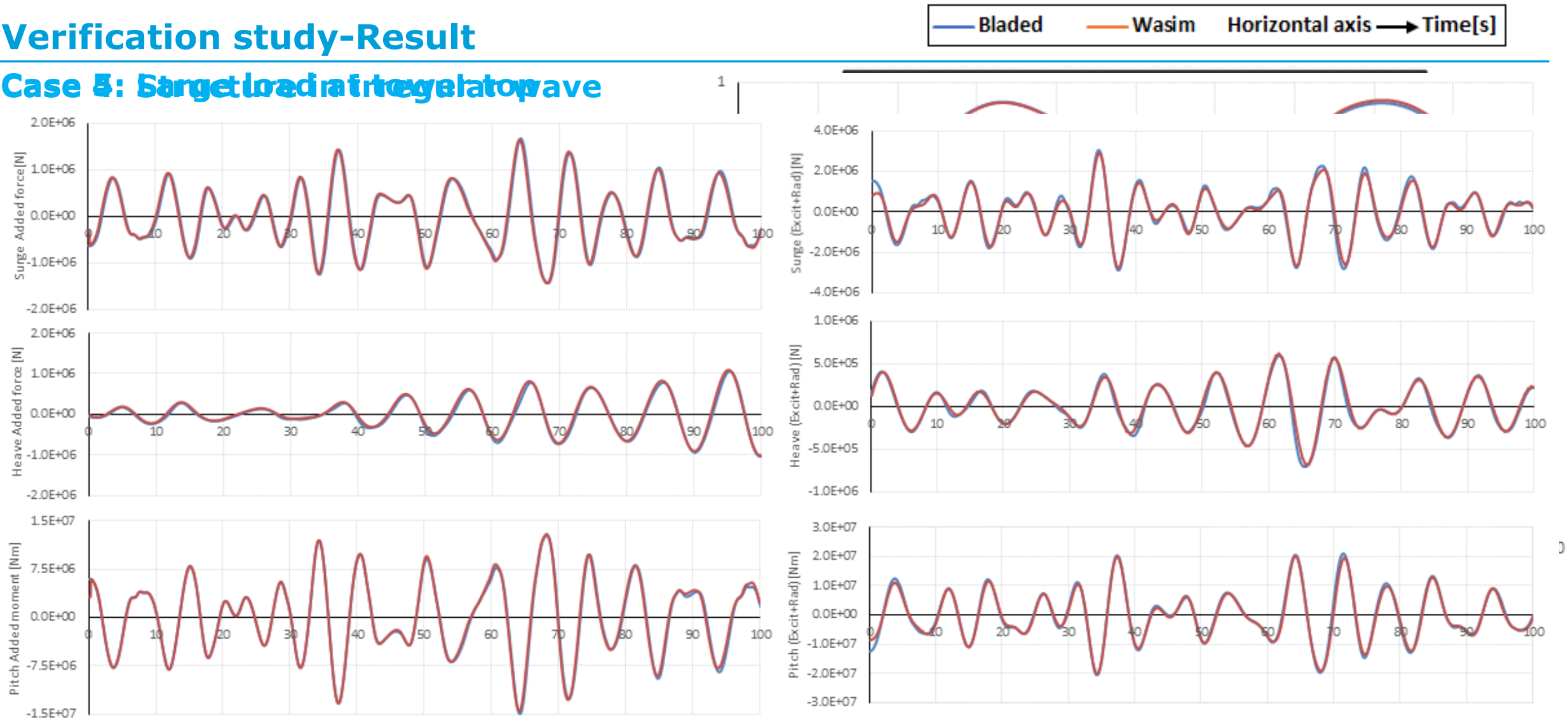
		Value	Unit
Dimensions	Diameter	20	m
	Height	40	m
	Draft	20	m
	Mass	6.44e6	kg
	COG	(0, 0, -20)	m
Locations	Water depth	100	m
	Water density	1030	Kg/m^3
Mooring system	stiffness	1.0e5	Kg/s^2
	Location	Z=-10 or Z=-20	m
Hydrodynamic coefficients	Verified between Wadam and Wasim. Wadam generated WAMIT files are input to Bladed.		

Verification study-test cases definition and purpose

Test No.	Test name	Mooring line definition/Test notes	Wave conditions	Prescribed files				Use of interface	Purpose of test
				motion	Mooring loads	Tower loads	SEA file		
1a	Free decay test heave	No mooring lines	Calm water	-	-	-	No	-	Verify modelling and Hydrodynamic inputs
1b	Free decay test pitch	No mooring lines	Calm water	-	-	-	No	-	
2	Fixed cylinder	Rigid Structure	Regular wave, H=2 m, T=8s	-	-	-	Yes	Yes	Verify Excitation force and Bladed/Wasim prescribed wave file (SEA file)
3a	Forced Heave decay	Single vertical mooring line with k_z~1e5)	Calm water	-	Yes	-	No	Yes	Verify Bladed/Wasim prescribed force (mooring loads)
3b	Forced Pitch Decay	Fore-aft horizontal mooring lines with k_x~1e5)	Calm water	-	Yes	-	No	Yes	
4a	Structure in regular waves	Fore-aft horizontal moorings with k_x~1e5)	Regular wave H=2 m, T=8s, heading=45 deg	Yes	-	-	Yes	Yes	verify prescribed of wave and motions files into Wasim and validate calculated loads on the structure i.e. hydrostatic and hydrodynamic loads
4b	Structure in irregular waves	Fore-aft horizontal moorings with k_x~1e5)	Sea file [Irregular with Hs = 2 m, Tp=8s, JONSWAP $\gamma = 1$	Yes	-	-	Yes	Yes	
5a	Thrust load at tower ramping up from t=0s	Fore-aft horizontal moorings with k_x~1e5) Constant thrust load applied at tower top	Calm water	-	-	Yes	No	Yes	Validate Bladed and Wasim results when a large load is applied on the tower top. Large load includes wind thrust and RNA mass.
5b	Gravity load at tower top in calm water	Fore-aft horizontal moorings with k_x~1e5) , a mass of 3160000 kg is added to nacelle	Calm water	-	-	Yes	No	Yes	

Verification study-Result

Case 4: Surge load in regular wave



Conclusions

- Bladed is a servo-hydro-aero-elastic tool that allows fully coupled analysis of a floating wind turbine
- Sesam's Wasim is a potential flow solver that enables detailed calculation of hydrodynamic loading on floating sub-structures
- A coupling interface has been developed that allows exchange of information between Bladed and Wasim, streamlining floater analysis
- Results show good agreement between the two tools, giving trust in the validity and correctness of the interface

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