Dynamic Analysis of a Braceless Semisubmersible Offshore Wind Turbine

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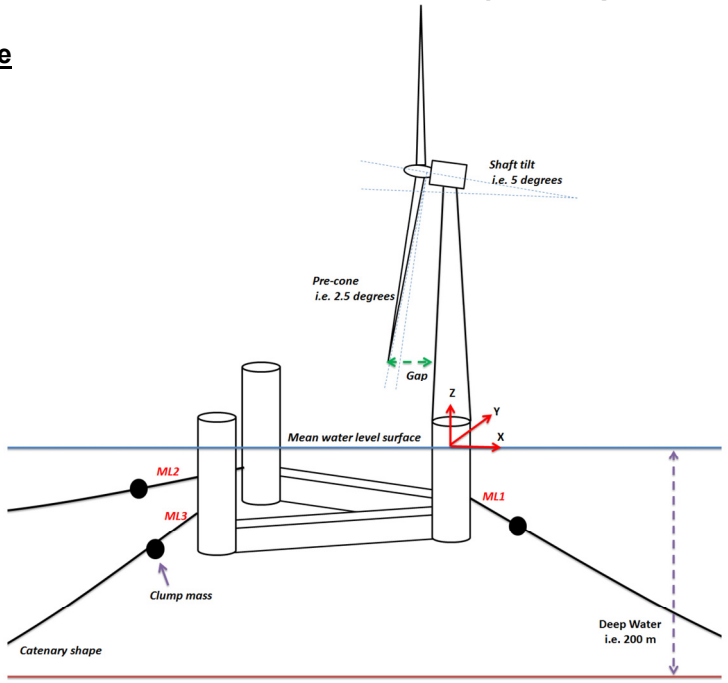
V-shaped 5MW semisubmersible offshore floating wind turbine

The V-shaped semisubmersible floating wind turbine consists of:
(a) a steel semisubmersible floating platform with three columns (one central column and two side columns) and two fully submerged pontoons connecting the side columns to the central column making a V-shape,
(b) a 5-MW wind turbine placed at the top of the central column of the semisubmersible platform and
(c) three catenary mooring lines positioned at the three columns of the semisubmersible.

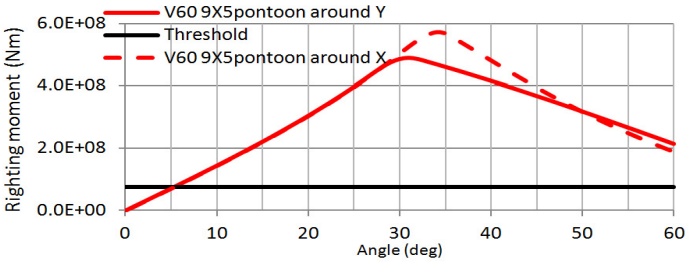
Properties

Buoyancy	10,014 m^3
Centre of buoyancy, CoB (x, y, z)	(-30.6, 0.0, -19.4) m
Pontoon dimensions, width x height	9 m x 5 m
Distance between columns	60 m
Diameter of columns	9 m
Draft	30 m
Freeboard	20 m
Weight of WT	600,000 kg
Weight of floater (structural steel mass)	1,630,000 kg
Total mass of V-shaped semisubmersible wind turbine	10,263,000 kg
Center of mass, CoG (x, y, z)	(-30.6, 0.0, -16.0) m



V-shaped semisubmersible offshore wind turbine applying braceless platform

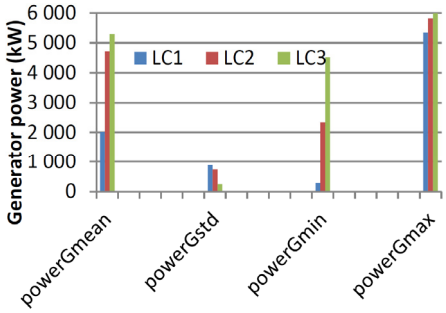
Stability analysis



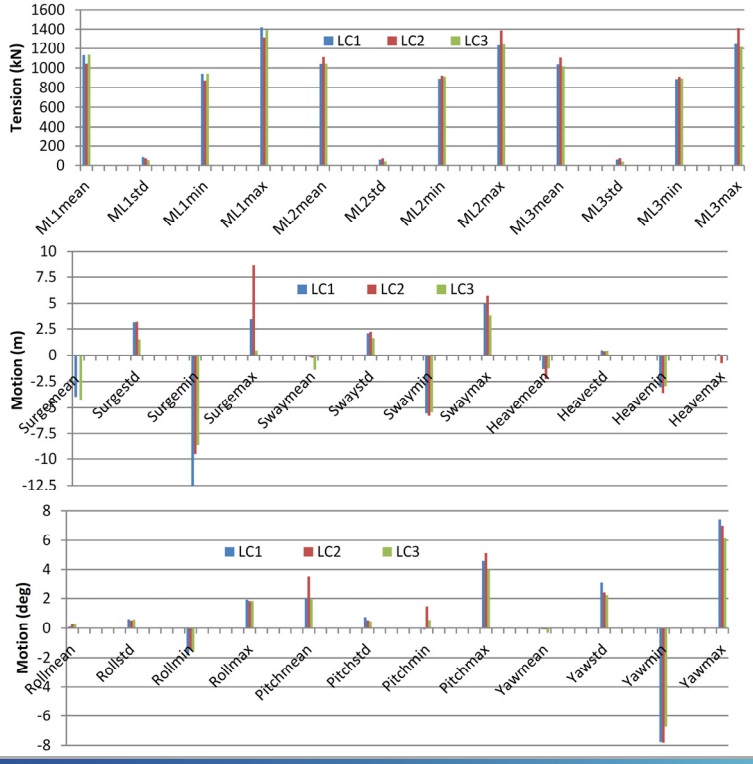
Load cases considered

LC	Uw (m/sec)	Hs (m)	Tp (sec)
LC1	8.0	1.7	9.5
LC2	11.4	3	10
LC3	18.0	4.2	10.5

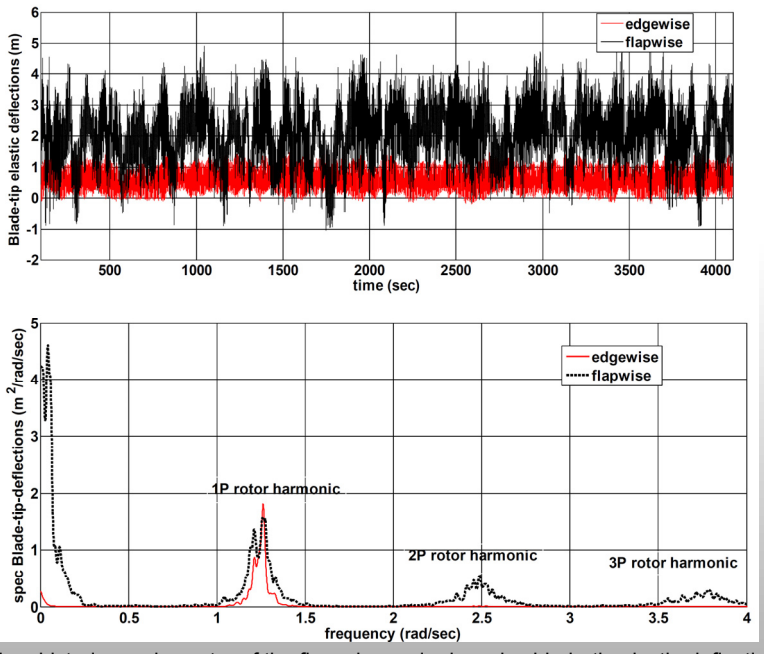
Power performance



Wave-wind-induced dynamics



Blade dynamics in coupled aero-hydro-servo-elastic analysis



Time histories and spectra of the flap-wise and edge-wise blade-tip elastic-deflection (relative with respect to the blade-root) for rated wind speed load case, LC2.