```
\ ------------------------------------------------------------------------------------------------------------
\ Environment OO-star
\ ------------------------------------------------------------------------------------------------------------
set_environment
 gravity:         on
 buoyancy:        on
 wind_force:      on
 hydro_force:     morison
 rho_water:       1025.
 rho_air:         1.225
 nu_water:        0.00001000
 nu_air:          0.00000100
 !
 waves:           irregular_airy_wavelets  !streamfunction  !extrapolated_airy   !none
 tshift_waves:        0.
 wave_ramps:          30.
 wave_rampe:          200.
 norder               1
 wave_amplitude:      0.
 spectral_peak:       10.
 wave_direction:      0.
 depth:               100.
 kinematics_option:  initial
 surface_option:     2ndorder    ! interpolated ! msl
 dtwkin:              .1
 !
 current_speed:     0.315
 current_exponent:  0.12
 current_direction: 0.
 !
 wind:            mean_profile
 tshift_wind:       0.
 wind_speed:        10.
```

wind_ref_height: 87.6

wind_exponent: .08

wind_direction: 0.

jonswap_wavelets_constant hs: 1.652 tp: 7.673 tstart: 19.99 tcut: 4.01 gamma: 1.

tperiodic 3600. depth: 95. file: wavelets.txt spread: 10.

wavelets scale_amplitude: 1. file wavelets.txt

!test_irreg_airy dt .01 nstep 1000 x 0. 0. 0. filename waveheight.txt

\ ----------

\ End of environmental setting

\----------

\\\ Main Geometry - materials and keypoints

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\

\Name rho E-mod G_mod

define_material name: Steel rho: 7800 e: 210000000000 g: 70000000000

define_material name: tower_dens rho: 7300 e: 210000000000 g: 210000000000

define_material name: Reinforced_conc rho: 2275 e: 30000000000 g: 70000000000

define_material name: ext_watbal rho: 1240.7 e: 30000000000 g: 70000000000

define_material name: ext_cyl_walls rho: 5638.5 e: 30000000000 g: 70000000000

define_material name: Nacelle rho: 0.0 e: 210000000000 g: 70000000000

define_material name: Chain rho: 7850 e: 39458300000 g: 808000 ! JBDV: reduced G stiffness by 0.0001 / 10 = 1e-5

define_material name: Reinforced_conc_CC rho: 3226.49713819676 e: 30000000000 g: 70000000000

define_material name: Reinforced_conc_CS rho: 2816.47568962454 e: 30000000000 g: 70000000000

define_material name massless1 rho 0.0001 e 210.e9 g 80.8e9

define_material name: steel1000 rho: 7800 e: 210.e15 g: 70.e15 ! TAN

define_material name: pontoon rho: 8330 e: 40000000000 g: 70000000000

define_material name: massless rho: 0 e: 21000000000000 g: 7000000000000

```
new_keypoints          ! node  #  x y z [m]
1 0 0 -20       ! center column bottom
3 0 0 -17       ! center column attachment
4 0 0 -11.5     ! Node for point mass
5 0 0 0         ! center still water node
6 0 0 10        ! NOT USED high-resolution (wave forces) up to here
7 0 0 13        ! tower base
8 0 0 47.8      ! Pressure centre for wind forces on tower
9 -7.102 0 -17        ! center shaft pontoon attachment
10 -24 0 -17       ! column 1 surface pontoon attachment
11 -31 0 -17        ! column 1 center  pontoon attachment
12 -31 0 -18.1073056998536     ! water level in column
13 -31 0 0       ! column 1 swl
14 -31 0 -20        ! column 1 bottom
15 -15.5 0 -17       ! Center of pontoon

new_boxmember_properties                    ! Pontoon, see python script for calculations
iprop:            1                         ! Property set no
material:  pontoon
connect_mode:       auto
btype:            beam !_lid1_lid2
ea1:  627200000000  ea2  627200000000                    ! axial stiffness at keypoints 1 and 2
eiy1:       3986602666666.67  eiy2:    3986602666666.67          ! EIyy bending stiffness, STIFFNESS
FOR BENDING ABOUT Z AXIS !
eiz1:  15605930666666.7  eiz2:  15605930666666.7              ! EIzz bending stiffness, STIFFNESS
FOR BENDING ABOUT Y AXIS !
lx1:          18.5     lx2:    18.5             ! equiv section length for use in drag calculations
ly1:          14.0     ly2:    14.0             ! section width  for use in drag calculations
lz1:          6.       lz2:    6.               ! section height for use in drag calculations
m1:       128157.2   m2:   128157.2        ! mass per unit length at keypoint 1 and 2
ab1:  99.82604728219   ab2:  99.82604728219           ! area for buoyancy calculation
pre_strain_long:     .0                     ! longitudal pre-strain. optional keywords from here
pointmass1:         0.    pointmass2: 0.
```

cdx: 0 cdy: 1.8 cdz: 3 ! drag coefficients Cm8 10.4

cmx: 1 cmy: 1.8 cmz: 3.5 ! inertia coefficients cmz 4.77

buoyancy_type: closed

new_boxmember_properties ! Pontoon, see python script for calculations

iprop: 2 ! Property set no

material: pontoon

connect_mode: auto

btype: beam !_lid1_lid2

ea1: 627200000000 ea2 627200000000 ! axial stiffness at keypoints 1 and 2

eiy1: 3986602666666.67 eiy2: 3986602666666.67 ! EIyy bending stiffness, STIFFNESS FOR BENDING ABOUT Z AXIS !

eiz1: 15605930666666.7 eiz2: 15605930666666.7 ! EIzz bending stiffness, STIFFNESS FOR BENDING ABOUT Y AXIS !

lx1: 18.5 lx2: 18.5 ! equiv section length for use in drag calculations

ly1: 14.0 ly2: 14.0 ! section width for use in drag calculations

lz1: 6. lz2: 6. ! section height for use in drag calculations

m1: 128157.2 m2: 128157.2 ! mass per unit length at keypoint 1 and 2

ab1: 99.82604728219 ab2: 99.82604728219 ! area for buoyancy calculation

pre_strain_long: .0 ! longitudal pre-strain. optional keywords from here

pointmass1: 0. pointmass2: 0.

cdx: 0 cdy: 1.8 cdz: 3 ! drag coefficients Cm8 10.4

cmx: 1 cmy: 1.8 cmz: 2 ! inertia coefficients cmz 4.77

buoyancy_type: closed

wave_forces cd_morison 1 cm_morison 1.4

\==========

\\\ Main Geometry - Floater & tower

\==========

\

\ Central tower

\

new_body

reftype: inertial

name: center_column

parent: inertial

axes: normal

new_elements_beam1 nelem 1 material Reinforced_conc connect_mode no_connect ! Bottom plate

x1 0 0 -20 dcyl1 13.8 tcyl1 6.8999 pre_strain_long 0.

x2 0 0 -19.4 dcyl2 13.8 tcyl2 6.8999 btype beam_lid1

cda 4 cma 7.6

new_elements_beam1 nelem 1 material Reinforced_conc connect_mode auto ! Bottom plate to pontoon attachment

x1 0 0 -19.4 dcyl1 13.8 tcyl1 0.4 pre_strain_long 0.

x2 0 0 -17 dcyl2 13.8 tcyl2 0.4 btype beam

cdn 1 cmn 1.8

new_elements_beam1 nelem 1 material Reinforced_conc connect_mode auto !Pontoon attachement to lower cone

x1 0 0 -17 dcyl1 13.8 tcyl1 0.4 pre_strain_long 0.

x2 0 0 -14 dcyl2 13.8 tcyl2 0.4 btype beam

cdn 1 cmn 1.8

new_elements_beam1 nelem 1 material Reinforced_conc_CS connect_mode auto !Cone

x1 0 0 -14 dcyl1 14.204 tcyl1 0.51 pre_strain_long 0. pointmass 0

x2 0 0 -11.5 dcyl2 13.2456666666667 tcyl2 0.494375 btype beam

cdn 1 cmn 1.8

new_elements_beam1 nelem 4 material Reinforced_conc_CS connect_mode auto !Cone

x1 0 0 -11.5 dcyl1 13.2456666666667 tcyl1 0.494375 pre_strain_long 0. pointmass 0

x2 0 0 -0.5 dcyl2 9.029 tcyl2 0.425625 btype beam

cdn 1 cmn 1.8

new_elements_beam1 nelem 2 material Reinforced_conc_CS connect_mode auto ! Cone to SWL

x1 0 0 -0.5 dcyl1 9.029 tcyl1 0.425625 pre_strain_long 0. pointmass 200000

x2 0 0 0 dcyl2 8.83733333333333 tcyl2 0.4225 btype beam

cdn 1 cmn 1.8

new_elements_beam1 nelem 2 material Reinforced_conc_CS connect_mode auto ! SWL + 0.5

x1 0 0 0 dcyl1 8.83733333333333 tcyl1 0.4225 pre_strain_long 0.

x2 0 0 0.88 dcyl2 8.5 tcyl2 0.417 btype beam

cdn 1 cmn 1.8

new_elements_beam1 nelem 4 material Reinforced_conc_CS connect_mode auto ! 0.5 to base of tower

x1 0 0 0.88 dcyl1 8.5 tcyl1 0.417 pre_strain_long 0.

x2 0 0 13 dcyl2 8.6 tcyl2 0.55 btype beam

cdn 1 cmn 1.8

\==========

\\ Tower Full scale + nacelle mass

new_body name tower reftype inertial parent inertial axes normal

! JBDV: Increased nelem from 1 to 2

new_elements_beam1 nelem 2 material tower_dens connect_mode auto ! Tower part1

x1 0 0 13 dcyl1 9.7 tcyl1 0.090 pre_strain_long 0.

x2 0 0 30 dcyl2 8.86 tcyl2 0.081 btype beam

! JBDV: Increased nelem from 1 to 2

new_elements_beam1 nelem 2 material tower_dens connect_mode auto ! Tower part2

x1 0 0 30 dcyl1 8.86 tcyl1 0.081 pre_strain_long 0.

x2 0 0 47.8 dcyl2 7.99197530864198 tcyl2 0.0665 btype beam

! JBDV: Increased nelem from 1 to 4

new_elements_beam1 nelem 4 material tower_dens connect_mode auto ! Tower part3

x1 0 0 47.8 dcyl1 7.99197530864198 tcyl1 0.0665 pre_strain_long 0.

x2 0 0 94.8 dcyl2 5.7 tcyl2 0.04 btype beam

! JBDV: Remove these two elements for better visualisation

! new_elements_beam1 nelem 1 material Nacelle connect_mode auto ! Nacelle1

! x1 0 0 94.8 dcyl1 4 tcyl1 2 pre_strain_long 0.

! x2 0 0 97.8 dcyl2 4 tcyl2 2 btype beam

! new_elements_beam1 nelem 1 material Nacelle connect_mode auto ! Nacelle2

! x1 0 0 97.8 dcyl1 4 tcyl1 2 pre_strain_long 0.

! x2 0 0 100.8 dcyl2 4 tcyl2 2 btype beam

\==========

\\ Pontoon 1 & external column 1

new_body

name: pontoon_1

reftype: refnode

xfind: 0. 0. 0.

rotorder: 123

rotation: 0. 0. 0.

axes: normal

parent: center_column

new_boxmembers nelem_default: 2 ! member_no keypoint_1 keypoint_2 Property_Set optional nelem

1 9 15 1 nelem: 3

new_boxmembers nelem_default: 2 ! member_no keypoint_1 keypoint_2 Property_Set optional nelem

2 15 10 2 nelem: 3

new_elements_beam1 nelem 1 material massless connect_mode auto ! Center shaft to pontoon

x1 0 0 -17 dcyl1 8 tcyl1 1.2 pre_strain_long 0.

x2 -7.102 0 -17 dcyl2 8 tcyl2 1.2 btype beamwb

cmn 1.000

new_elements_beam1 nelem 1 material massless connect_mode auto ! Exentric shaft to pontoon

x1 -24 0 -17 dcyl1 8 tcyl1 1.2 pre_strain_long 0.

x2 -31 0 -17 dcyl2 8 tcyl2 1.2 btype beamwb

cmn 1.000

!==========

!! External Column 1

new_elements_beam1 nelem 1 material Reinforced_conc connect_mode auto ! Heave plate bot

x1 -31 0 -20 dcyl1 21 tcyl1 10.499 pre_strain_long 0.

x2 -31 0 -19.8 dcyl2 21 tcyl2 10.499 btype beam_lid1

cda 3 cma 1.55

new_elements_beam1 nelem 1 material Reinforced_conc connect_mode auto ! Heave plate top

x1 -31 0 -19.8 dcyl1 21 tcyl1 10.499 pre_strain_long 0.

x2 -31 0 -19.6 dcyl2 21 tcyl2 10.499 btype beam_lid2

cda 3 cma 1.55

new_elements_beam1 nelem 1 material ext_watbal connect_mode auto ! Heave plate to water level

x1 -31 0 -19.6 dcyl1 14 tcyl1 6.9999 pre_strain_long 0.

x2 -31 0 -17.7073056998536 dcyl2 14 tcyl2 6.9999 btype beam_lid1

cdn 1 cmn 1.8

new_elements_beam1 nelem 1 material ext_cyl_walls connect_mode auto ! water level to Pontoon attachment

x1 -31 0 -17.7073056998536 dcyl1 14 tcyl1 0.4 pre_strain_long 0.

x2 -31 0 -17 dcyl2 14 tcyl2 0.4 btype beam

cdn 1 cmn 1.8

new_elements_beam1 nelem 1 material ext_cyl_walls connect_mode auto ! Pontoon attachment to Cone

x1 -31 0 -17 dcyl1 14 tcyl1 0.4 pre_strain_long 0.

x2 -31 0 -14 dcyl2 14 tcyl2 0.4 btype beam

cdn 1 cmn 1.8

new_elements_beam1 nelem 3 material Reinforced_conc_CC connect_mode auto ! Cone

x1 -31 0 -14 dcyl1 14 tcyl1 0.435 pre_strain_long   0.

x2 -31 0 -3.1 dcyl2 12 tcyl2 0.38 btype beam

cdn 1 cmn 1.8

new_elements_beam1 nelem 3 material Reinforced_conc_CC connect_mode auto ! Cone to SWL

x1 -31 0 -3.1 dcyl1 12 tcyl1 0.3 pre_strain_long   0.

x2 -31 0 0 dcyl2 12 tcyl2 0.3 btype beam

cdn 1 cmn 1.8

new_elements_beam1 nelem 1 material Reinforced_conc_CC connect_mode auto ! SWL to +0.5

x1 -31 0 0 dcyl1 12 tcyl1 0.3 pre_strain_long   0.

x2 -31 0 0.5 dcyl2 12 tcyl2 0.3 btype beam

cdn 1 cmn 1.8

new_elements_beam1 nelem 3 material Reinforced_conc_CC connect_mode auto ! SWL to top of cone

x1 -31 0 0.5 dcyl1 12 tcyl1 0.3 pre_strain_long   0.

x2 -31 0 12 dcyl2 12 tcyl2 0.3 btype beam_lid2

cdn 1 cmn 1.8

new_elements_beam1 nelem 1 material Steel connect_mode auto ! Top slap on cyliner (steel)

x1 -31 0 12 dcyl1 11.43 tcyl1 5.7149 pre_strain_long   0.

x2 -31 0 12.05 dcyl2 11.43 tcyl2 5.7149 btype beam

cdn 1 cmn 1.8

\==========

\ Mooring attachment

new_elements_beam1 nelem 1   material massless connect_mode connect_1 ! Attachment column to mooring

x1 -31 0 12 dcyl1 8 tcyl1 1.2 pre_strain_long   0.

x2 -37 0 12 dcyl2 8 tcyl2 1.2 btype beamwb

cmn 1.000

\==========

\\ Pontoon 2 & external column 2

new_body

name: pontoon_2

reftype: refnode Total for all elements

xfind: 0. 0. 0.

rotorder: 123

rotation: 0. 0. 120.

axes: normal

parent: center_column

copy_elements

from_body: pontoon_1

to_body: pontoon_2

!==========

!! Pontoon 3 & external column 3

new_body

name: pontoon_3

reftype: refnode

xfind: 0. 0. 0.

rotorder: 123

rotation: 0. 0. -120.

axes: normal

parent: center_column

copy_elements

from_body: pontoon_1

to_body: pontoon_3

\==========

\\ End of Floater Geometry

\----------

```
\\ Main geometry - Mooring lines
\----------------------------------------------------------------------------------------------------------------
\ Mooring line 1
\----------------------------------------------------------------------------------------------------------------
new_body
reftype: inertial
name:    mooring
parent:  inertial
axes:    normal

\Seg 1  Mooring line 1
new_elements_beam1  nelem 2 material  Chain connect_mode auto  ! Mooring line segment 1
x1 -37  0  12   dcyl1   0.2648   tcyl1   0.1323   pre_strain_long 0.0
x2 -29.657  0  -6.603   dcyl2   0.2648   tcyl2   0.1323   btype cable
frac_stiff   0.0001  cdn    3.15 cda 80.46 cmn 7.95

\Seg 2  Mooring line 1
new_elements_beam1  nelem 2 material  Chain connect_mode auto  ! Mooring line segment 2
x1 -29.657  0  -6.603   dcyl1   0.2648   tcyl1   0.1323   pre_strain_long 0.0
x2 -22.314  0  -25.206   dcyl2   0.2648   tcyl2   0.1323   btype cable
frac_stiff   0.0001  cdn    3.15 cda 80.46 cmn 7.95

\Seg 3  Mooring line 1
new_elements_beam1  nelem 4 material  Chain connect_mode auto  ! Mooring line segment 3
x1 -22.314  0  -25.206   dcyl1   0.2648   tcyl1   0.1323   pre_strain_long 0.0
x2 -42.212  0  -27.223   dcyl2   0.2648   tcyl2   0.1323   btype cable
frac_stiff   0.0001  cdn    3.15 cda 80.46 cmn 7.95

\Seg 4  Mooring line 1
new_elements_beam1  nelem 2 material  Chain connect_mode auto  ! Mooring line segment 4
x1 -42.212  0  -27.223   dcyl1   0.2648   tcyl1   0.1323   pre_strain_long 0.0
x2 -62.11  0  -29.24   dcyl2   0.2648   tcyl2   0.1323   btype cable
frac_stiff   0.0001  cdn    3.15 cda 80.46 cmn 7.95
```

\Seg 5 Mooring line 1 !JBDV changed nelem from 2 -> 4 (10m segments)

new_elements_beam1 nelem 4 material Chain connect_mode auto ! Mooring line segment 5

x1 -62.11 0 -29.24   dcyl1   0.2648   tcyl1   0.1323   pre_strain_long 0.0

x2 -101.906 0 -33.273   dcyl2   0.2648   tcyl2   0.1323   btype cable

frac_stiff   0.0001 cdn   3.15 cda 160.92 cmn 7.95

\Seg 6 Mooring line 1

new_elements_beam1 nelem 2 material Chain connect_mode auto ! Mooring line segment 6

x1 -101.906 0 -33.273   dcyl1   0.2648   tcyl1   0.1323   pre_strain_long 0.0

x2 -121.804 0 -35.29   dcyl2   0.2648   tcyl2   0.1323   btype cable

frac_stiff   0.0001 cdn   3.15 cda 80.46 cmn 7.95

\Seg 7 Mooring line 1 !JBDV changed nelem from 12 -> 16 (20m segments)

new_elements_beam1 nelem 16 material Chain connect_mode auto ! Mooring line segment 7

x1 -121.804 0 -35.29   dcyl1   0.2648   tcyl1   0.1323   pre_strain_long 0.0

x2 -440.173 0 -67.558   dcyl2   0.2648   tcyl2   0.1323   btype cable

frac_stiff   0.0001 cdn   2.24 cda 916.38 cmn 5.44

\Seg 8 Mooring line 1 !JBDV changed nelem from 4 -> 8 (32m segments)

new_elements_beam1 nelem 8 material Chain connect_mode auto ! Mooring line segment 8

x1 -440.173 0 -67.558   dcyl1   0.2648   tcyl1   0.1323   pre_strain_long 0.0

x2 -728.695 0 -96.8   dcyl2   0.2648   tcyl2   0.1323   btype cable

frac_stiff   0.0001 cdn   2.24 cda 830.47 cmn 5.44

\Connection to anchor - for monitoring of loads and displacements Mooring line 1

new_elements_beam1 nelem 1 material massless connect_mode auto ! Mooring line segment 8

x1 -728.695 0 -96.8   dcyl1   3   tcyl1   1.4999   pre_strain_long 0.0

x2 -729.695 0 -96.8   dcyl2   3   tcyl2   1.4999   btype beam

cdn   0 cmn   1

\----------

```
\-----------------------------------------------------------------------------------------------------------------------
\  Mooring line 2
\-----------------------------------------------------------------------------------------------------------------------

\Seg 1  Mooring line 2
new_elements_beam1  nelem 2 material  Chain connect_mode auto  ! Mooring line segment 1
x1 18.5  -32.0429399400242  12   dcyl1   0.2648   tcyl1   0.1323   pre_strain_long 0.0
x2 14.8285  -25.6837154000351  -6.603   dcyl2   0.2648   tcyl2   0.1323   btype cable
frac_stiff   0.0001  cdn    3.15 cda 80.46 cmn 7.95

\Seg 2  Mooring line 2
new_elements_beam1  nelem 2 material  Chain connect_mode auto  ! Mooring line segment 2
x1 14.8285  -25.6837154000351  -6.603   dcyl1   0.2648   tcyl1   0.1323   pre_strain_long 0.0
x2 11.157  -19.324490860046  -25.206   dcyl2   0.2648   tcyl2   0.1323   btype cable
frac_stiff   0.0001  cdn    3.15 cda 80.46 cmn 7.95

\Seg 3  Mooring line 2
new_elements_beam1  nelem 4 material  Chain connect_mode auto  ! Mooring line segment 3
x1 11.157  -19.324490860046  -25.206   dcyl1   0.2648   tcyl1   0.1323   pre_strain_long 0.0
x2 21.106  -36.5566643445487  -27.223   dcyl2   0.2648   tcyl2   0.1323   btype cable
frac_stiff   0.0001  cdn    3.15 cda 80.46 cmn 7.95

\Seg 4  Mooring line 2
new_elements_beam1  nelem 2 material  Chain connect_mode auto  ! Mooring line segment 4
x1 21.106  -36.5566643445487  -27.223   dcyl1   0.2648   tcyl1   0.1323   pre_strain_long 0.0
x2 31.055  -53.7888378290515  -29.24   dcyl2   0.2648   tcyl2   0.1323   btype cable
frac_stiff   0.0001  cdn    3.15 cda 80.46 cmn 7.95

\Seg 5  Mooring line 2 !JBDV changed nelem from 2 -> 4 (10m segments)
new_elements_beam1  nelem 4 material  Chain connect_mode auto  ! Mooring line segment 5
x1 31.055  -53.7888378290515  -29.24   dcyl1   0.2648   tcyl1   0.1323   pre_strain_long 0.0
x2 50.953  -88.253184798057  -33.273   dcyl2   0.2648   tcyl2   0.1323   btype cable
frac_stiff   0.0001  cdn    3.15 cda 160.92 cmn 7.95
```

\Seg 6 Mooring line 2

new_elements_beam1 nelem 2 material Chain connect_mode auto ! Mooring line segment 6

x1 50.953 -88.253184798057 -33.273   dcyl1   0.2648   tcyl1   0.1323   pre_strain_long 0.0

x2 60.902 -105.48535828256 -35.29   dcyl2   0.2648   tcyl2   0.1323   btype cable

frac_stiff   0.0001 cdn   3.15 cda 80.46 cmn 7.95

\Seg 7 Mooring line 2 !JBDV changed nelem from 12 -> 16 (20m segments)

new_elements_beam1 nelem 16 material Chain connect_mode auto ! Mooring line segment 7

x1 60.902 -105.48535828256 -35.29   dcyl1   0.2648   tcyl1   0.1323   pre_strain_long 0.0

x2 220.0865 -381.201000060008 -67.558   dcyl2   0.2648   tcyl2   0.1323   btype cable

frac_stiff   0.0001 cdn   2.24 cda 916.38 cmn 5.44

\Seg 8 Mooring line 2 !JBDV changed nelem from 4 -> 8 (32m segments)

new_elements_beam1 nelem 8 material Chain connect_mode auto ! Mooring line segment 8

x1 220.0865 -381.201000060008 -67.558   dcyl1   0.2648   tcyl1   0.1323   pre_strain_long 0.0

x2 364.3475 -631.068381610702 -96.8   dcyl2   0.2648   tcyl2   0.1323   btype cable

frac_stiff   0.0001 cdn   2.24 cda 830.47 cmn 5.44

\----------

\ Mooring line 3

\----------

\Seg 1 Mooring line 3

new_elements_beam1 nelem 2 material Chain connect_mode auto ! Mooring line segment 1

x1 18.5 32.0429399400242 12   dcyl1   0.2648   tcyl1   0.1323   pre_strain_long 0.0

x2 14.8285 25.6837154000351 -6.603   dcyl2   0.2648   tcyl2   0.1323   btype cable

frac_stiff   0.0001 cdn   3.15 cda 80.46 cmn 7.95

\Seg 2 Mooring line 3

new_elements_beam1 nelem 2 material Chain connect_mode auto ! Mooring line segment 2

x1 14.8285 25.6837154000351 -6.603   dcyl1   0.2648   tcyl1   0.1323   pre_strain_long 0.0

x2 11.157 19.324490860046 -25.206   dcyl2   0.2648   tcyl2   0.1323   btype cable

frac_stiff   0.0001 cdn   3.15 cda 80.46 cmn 7.95

\Seg 3 Mooring line 3

new_elements_beam1 nelem 4 material Chain connect_mode auto ! Mooring line segment 3

x1 11.157 19.324490860046 -25.206   dcyl1   0.2648   tcyl1   0.1323   pre_strain_long 0.0

x2 21.106 36.5566643445487 -27.223   dcyl2   0.2648   tcyl2   0.1323   btype cable

frac_stiff   0.0001 cdn   3.15 cda 80.46 cmn 7.95

\Seg 4 Mooring line 3

new_elements_beam1 nelem 2 material Chain connect_mode auto ! Mooring line segment 4

x1 21.106 36.5566643445487 -27.223   dcyl1   0.2648   tcyl1   0.1323   pre_strain_long 0.0

x2 31.055 53.7888378290515 -29.24   dcyl2   0.2648   tcyl2   0.1323   btype cable

frac_stiff   0.0001 cdn   3.15 cda 80.46 cmn 7.95

\Seg 5 Mooring line 3 !JBDV changed nelem from 2 -> 4 (10m segments)

new_elements_beam1 nelem 4 material Chain connect_mode auto ! Mooring line segment 5

x1 31.055 53.7888378290515 -29.24   dcyl1   0.2648   tcyl1   0.1323   pre_strain_long 0.0

x2 50.953 88.253184798057 -33.273   dcyl2   0.2648   tcyl2   0.1323   btype cable

frac_stiff   0.0001 cdn   3.15 cda 160.92 cmn 7.95

\Seg 6 Mooring line 3

new_elements_beam1 nelem 2 material Chain connect_mode auto ! Mooring line segment 6

x1 50.953 88.253184798057 -33.273   dcyl1   0.2648   tcyl1   0.1323   pre_strain_long 0.0

x2 60.902 105.48535828256 -35.29   dcyl2   0.2648   tcyl2   0.1323   btype cable

frac_stiff   0.0001 cdn   3.15 cda 80.46 cmn 7.95

\Seg 7 Mooring line 3 !JBDV changed nelem from 12 -> 16 (20m segments)

new_elements_beam1 nelem 16 material Chain connect_mode auto ! Mooring line segment 7

x1 60.902 105.48535828256 -35.29   dcyl1   0.2648   tcyl1   0.1323   pre_strain_long 0.0

x2 220.0865 381.201000060008 -67.558   dcyl2   0.2648   tcyl2   0.1323   btype cable

frac_stiff   0.0001 cdn   2.24 cda 916.38 cmn 5.44

\Seg 8 Mooring line 3 !JBDV changed nelem from 4 -> 8 (32m segments)

new_elements_beam1 nelem 8 material Chain connect_mode auto ! Mooring line segment 8

x1 220.0865 381.201000060008 -67.558   dcyl1   0.2648   tcyl1   0.1323   pre_strain_long 0.0

```
x2 364.3475  631.068381610702  -96.8   dcyl2   0.2648   tcyl2   0.1323   btype cable
frac_stiff   0.0001  cdn    2.24 cda 830.47 cmn 5.44
\-------------------------------------------------------------------------------------------------------------
\\ End of mooring geometry
\-------------------------------------------------------------------------------------------------------------
\\ End of Main Geometry
\=============================================================================
\-----------------------------------------------------------------------
\ RNA 6MW flexible blade system - without attached
\-----------------------------------------------------------------------
! 3dfloat definition of Statoil 6MW 154m generic rotor
! Created by:   Tor Anders Nygaard May 22, 2014
!
! Implement generator eta from table
! compare generator eff with dll
! check vaxial to controller

define_material name massless1    rho 0.0001       e  210.e9 g  80.8e9
define_material name mod_nacelle  rho 5587.5       e  210.e9 g  70.e9
! ------------------------------------------------------------------------------------------------------------
! NACELLE DEFINITIONS:
! ------------------------------------------------------------------------------------------------------------
! yaw drive
new_body name yawdrive parent tower reftype refnode xfind 0. 0. 94.8
rotorder 123 rotation 0. 0. 0. axes normal   ! yaw can be added here eg rotation  0.  0.  8.

! yaw bearing to Nacelle reference point
! mass 9 ton
new_elements_beam1 nelem 1 material steel1000  connect_mode connect_1
x1   0.   0.  0.     dcyl1 4.0   tcyl1  0.0409686373997
x2   0.   0.  3.0    dcyl2 4.0   tcyl2  0.0409686373997  btype beam
```

```
! nacelle
new_body name nacelle parent yawdrive reftype refnode xfind 0. 0. 3.0
rotorder 123 rotation 0. 6. 0. axes normal ! rotor tilt: 6 degrees      ! dbg  rotation 0. 6. 0.

! nacelle ref point to rotor counterweight
! mass 30 ton
new_elements_beam1 nelem 1 material steel1000  connect_mode connect_1
x1   0.    0.  0.     dcyl1 4.0   tcyl1  0.0393770908273
x2   7.8   0.  0.     dcyl2 4.0   tcyl2  0.0393770908273  btype beam

! half rotor counterweight
! mass .5*(80 + 61)ton
new_elements_beam1 nelem 1 material steel1000  connect_mode connect_2
x1   6.8   0.  0.     dcyl1 4.0   tcyl1  0.93168666634785957
x2   7.8   0.  0.     dcyl2 4.0   tcyl2  0.93168666634785957  btype beam

! another half rotor counterweight
! mass .5*(80 + 61)ton
new_elements_beam1 nelem 1 material steel1000  connect_mode connect_1
x1   7.8   0.  0.     dcyl1 4.0   tcyl1  0.93168666634785957
x2   8.8   0.  0.     dcyl2 4.0   tcyl2  0.93168666634785957  btype beam

! shaft from main bearing to nacelle ref point
new_elements_beam1 nelem 1 material steel1000  connect_mode connect_2
x1 -6.     0. 0. dcyl1 4.0 tcyl1 0.0393770908273
x2  0.     0. 0. dcyl2 4.0 tcyl2 0.0393770908273 btype beam

! mainbearing
new_body name mainbearing parent nacelle reftype refnode
xfind -6. 0. 0. rotorder 123 rotation  0. 0. 0. axes normal

shaft next element
! shaft from hub CG to moment sensor
```

new_elements_beam1 nelem 1 material steel1000 connect_mode no_connect

x1 -1.8 0.   0. dcyl1 4.0   tcyl1 0.0393770908273

x2 -1.   0.   0. dcyl2 4.0   tcyl2 0.0393770908273 btype beam

generator statoil_154m

!shaft_element_position: -7.3808E+00   0.0000E+00   9.8206E+01   ! with 6 deg tilt

!   -7.4215E+00   0.0000E+00   9.7430E+01   ! with 0 deg tilt

! moment sensor

!

new_elements_beam1 nelem 1 material steel1000 !s355j2g3

connect_mode connect_both

x1 -1. 0. 0. dcyl1 4.0 tcyl1 0.0393770908273

x2 0. 0. 0. dcyl2 4.0 tcyl2 0.0393770908273 btype beam

! hub

new_body

 name: hub

 parent: mainbearing

 reftype: refnode   xfind   -1.8   0. 0.

 rotorder: 123

 rotation: 0. 0.   0.

 axes: normal

generator name: statoil_154m gen_eta: 1.   ! mgen here is mechanical. El power = omega*mgen*eta

scale_omega: 0.90909090 ! TAN modified from nominal rpm 11 to 10

scale_mgen: 1.1   ! TAN modified from max power at 11 rpm to 10.

omega: mgen: ! [rad/s] [Nm]

0.182840692439 0.0

0.387567813698 430141.912747

0.441498487584 621442.571746

0.54674184148 1292009.93602

0.603395228999 1680263.65716

0.660153336274 2079292.64135

0.718586959631 2498248.64116

0.785607602908 2985179.20285

0.839014678019 3374700.07262

0.890536797538 3753666.44906

0.948970420894 4183570.14056

1.03326982377 4802855.55266

1.10207070288 5307247.30492

1.15191730632 5686051.22915

1.18961641816 5964681.08692

omega_eta: eta:

0.182840692439 0.85

1.15191730632 0.91605

! blade element structural coordinate system:

!

! y out TE along flap principal axis

! z out suction side along lag principal axis

! x = y x z ! NB CAN THEREFORE BE TOWARDS TIP OR HUB

!

! structural twist is positive around x

! mass center and shear center offsets are given in blade element structural

! coordinate system

!

! distributed structural properties for blade

!

r[m],eiflap[Nm**2],eiedge[Nm**2],gtors[Nm**2],ea[N],rho[kg/m],structwist[deg],flpinert[kgm],edginert[kgm],&

! flpcgofs[m],edgcgofs[m],flpshrofs[m],edgshrofs[m]

!

read_airfoil

file Z:\3dfloat\3dfloat\airfoils\Cylinder1.dat afname Cylinder1 thick 1.

read_airfoil

file Z:\3dfloat\3dfloat\airfoils\NACA4415_RE6E6.dat afname NACA4415 thick .15

read_airfoil

file Z:\3dfloat\3dfloat\airfoils\NACA4418_RE6E6.dat afname NACA4418 thick .18

read_airfoil

file Z:\3dfloat\3dfloat\airfoils\NACA4421_RE6E6.dat afname NACA4421 thick .21

read_airfoil

file Z:\3dfloat\3dfloat\airfoils\NACA4424_RE6E6.dat afname NACA4424 thick .24

read_airfoil

file Z:\3dfloat\3dfloat\airfoils\NACA4430_RE6E6.dat afname NACA4430 thick .30

!0. 1.3013E+11 1.3013E+11 1.0039E+11 3.5669E+11 13333.33 0.00 1. 1. 0. 0. 0. 0. ! hub 80 ton 0 to 2m

!1.999 1.3013E+11 1.3013E+11 1.0039E+11 3.5669E+11 13333.33 0.00 1. 1. 0. 0. 0. 0. ! hub 80 ton 0 to 2m

! JBDV: Change blade twist from 0.0 to 37.0 for the first two elements in this table - for visualisation

blade_table blname: 6mwgeneric stiffness_option: global ! stored in bltable()%r,eiflap ...

2. 30.0e9 30.0e9 2.3e11 -1. 1260. 37.00 1. 1. 0. 0. 0. 0. ! torsion increased 10X

3.5 30.0e9 30.0e9 -1 -1. 1184. 37.00 1. 1. 0. 0. 0. 0. ! extra line to provide pitch sensor with no twist

5.0 30.0e9 30.0e9 -1. -1. 774. 37.00 1. 1. 0. 0. 0. 0. ! dbg twist 37. deg

10.0 13.0e9 27.0e9 -1. -1. 649. 20.10 1. 1. 0. 0. 0. 0.

15.0 7.5e9 14.0e9 -1. -1. 525. 11.20 1. 1. 0. 0. 0. 0.

20.0 5.0e9 12.5e9 -1. -1. 430. 5.50 1. 1. 0. 0. 0. 0.

25.0 3.5e9 10.0e9 -1. -1. 405. 2.50 1. 1. 0. 0. 0. 0.

30.0 2.4e9 8.0e9 -1. -1. 378. 1.00 1. 1. 0. 0. 0. 0.

35.0 1.8e9 6.0e9 -1. -1. 342. 0.10 1. 1. 0. 0. 0. 0.

40.0 11.e8 4.8e9 -1. -1. 300. 0.00 1. 1. 0. 0. 0. 0.

45.0 7.7e8 4.2e9 -1. -1. 252. -0.70 1. 1. 0. 0. 0. 0.

50.0 4.5e8 3.2e9 -1. -1. 216. -1.80 1. 1. 0. 0. 0. 0.

55.0 2.7e8 2.5e9 -1. -1. 171. -2.30 1. 1. 0. 0. 0. 0.

60.0 1.7e8 1.8e9 -1. -1. 135. -2.40 1. 1. 0. 0. 0. 0.

65.0 1.2e8 1.3e9 -1. -1. 99. -2.90 1. 1. 0. 0. 0. 0.

70.0 7.0e7 7.5e8 -1. -1. 80. -3.20 1. 1. 0. 0. 0. 0.

75.0 3.0e7 3.75e8 -1. -1. 50. -1.00 1. 1. 0. 0. 0. 0.

76.5 7.0e6 17.5e7 -1. -1. 36. -0.10 1. 1. 0. 0. 0. 0.

76.9 1.5e5 7.5e5 -1. -1. 25. 0.0 1. 1. 0. 0. 0. 0. ! extra line, elastic tip twist sensor

77.001 1.5e5 7.5e5 -1. -1. 25. 0.0 1. 1. 0. 0. 0. 0.

! JBDV: Change blade twist from 0.0 to 37.0 for the first two elements in this table - for visualisation

aero_blade_table blname: 6mwgeneric ! r/R c/R twist[deg] t/c airfoil ! stored in bltable()%ra,chord,atwist,airfoil

0. 0.038961038961 37. 1. interpolate

0.025974025974 0.038961038961 37. 1. interpolate

0.0649350649351 0.038961038961 37. 1. Cylinder1

0.12987012987 0.0428571428571 20.1 .78 interpolate

0.194805194805 0.0844155844156 11.2 .36 interpolate

0.25974025974 0.0831168831169 5.5 .3 NACA4430

0.324675324675 0.0714285714286 2.5 .3 interpolate

0.38961038961 0.0597402597403 1. .3 interpolate

0.454545454545 0.0519480519481 0.1 .3 NACA4430

0.519480519481 0.0454545454545 0.0 .28 interpolate

0.584415584416 0.038961038961 -0.7 .265 interpolate

0.62770562770 0.0366233766233 -1.43 .24 NACA4424

0.649350649351 0.0354545454545 -1.8 .237 interpolate

0.714285714286 0.0319480519481 -2.3 .212 interpolate

0.779220779221 0.0285714285714 -2.4 .21 NACA4421

0.844155844156 0.0250649350649 -2.9 .189 interpolate

0.873376623376 0.0234870129870 -3.035 .18 NACA4418

0.909090909091 0.0215584415584 -3.2 .169 interpolate

0.974025974026 0.0194805194805 -1.0 .152 interpolate

0.993506493506 0.0168831168831 -0.1 .15 NACA4415

1.000 0.0038961038961 0.0 .15 interpolate

```
! ------------------------------------------------------------------------------------------

! BLADE STRUCTURE

! ------------------------------------------------------------------------------------------

! blade 1

! blade_1_root - body coordinate system that does not pitch

new_body name blade_1_root parent hub reftype refnode xfind -1.8 0. 0.

rotorder 321 rotation 0. -2. 0. axes normal   ! dbg bcone angle 0. -2. 0.


! blade_1_pitching - this body has coordinate system that pitches (user defined pre-pitch)

new_body name blade_1_pitching parent blade_1_root reftype refnode

xfind 0. 0. 0. rotorder 321 rotation 0. 0. 0. axes normal ! pitch (z axis) eg for failure cases


blade 1 pitch actuation blade second element from here  ! useful for log file to pick out coordinates


! from blade root to hub CG 1/3 of hub mass (80t/3), never mind angular momentum of hub
compared to blades

! Got rid of point mass here, no node force due to gravity needed

! The middle of the 3 elements is used for pitch actuation

!

new_elements_beam1  nelem 3  material s355j2g3  connect_mode connect_2

x1 0. 0. 2.  dcyl1 2.0 tcyl1 0.3222491125

x2 0. 0. 0.  dcyl2 2.0 tcyl2 0.3222491125  btype beam


! from blade tip to root

! mass is supposed to be 61ton/3, have to adjist quite a bit. Checked mass in separate calculation, 3df
is OK.

! scale factor for 20 elements: 0.8115465974855319


new_elements_beam1 nelem 1 material massless1 connect_mode no_connect

x1 0. 0. 77.   dcyl1 1. tcyl1 .45

x2 0. 0. 76.9  dcyl2 1. tcyl2 .45 btype beam

blname 6mwgeneric scale_mass 0.8115465974855319 frac_stiff 1.
```

new_elements_beam1 nelem 20 material massless1 connect_mode connect_1

x1 0. 0. 76.9 dcyl1 1. tcyl1 .45

x2 0. 0. 3.5 dcyl2 3. tcyl2 .45 btype beam

blname 6mwgeneric scale_mass 0.8115465974855319 frac_stiff 1.

new_elements_beam1 nelem 1 material massless1 connect_mode connect_both

x1 0. 0. 3.5 dcyl1 3. tcyl1 .45

x2 0. 0. 2.   dcyl2 3. tcyl2 .45 btype beam

blname 6mwgeneric scale_mass 0.8115465974855319 frac_stiff 1.

! new body that pitches with the blade root, given by the pitch controller

new_body reftype refnode   xfind   0.   0. 2. !3.5

rotorder 321   rotation 0. 0. 0.   axes normal !

name blade_1_pcontrol parent blade_1_pitching

! blade 2

! blade_2_root - body coordinate system that does not pitch

new_body name blade_2_root parent hub reftype refnode xfind -1.8 0. 0.

rotorder 321 rotation 120. -2.   0.   axes normal   ! dbg cone rotation 120. -2.   0.

! blade_2_pitching - this body has coordinate system that pitches

new_body name blade_2_pitching parent blade_2_root reftype refnode

xfind 0. 0. 0. rotorder 321 rotation 0. 0. 0. axes normal ! pitch (z axis)

blade 2 pitch actuation blade 2 elements from here ! useful for log file to pick out coordinates

copy_elements

from_body: blade_1_pitching

to_body: blade_2_pitching

!new_elements_beam1 nelem 3 material s355j2g3 connect_mode connect_2

!x1 0. 0. 2. dcyl1 2.0 tcyl1 0.3222491125

!x2 0. 0. 0. dcyl2 2.0 tcyl2 0.3222491125 btype beam

```
! from blade tip to root
!new_elements_beam1 nelem 20 material massless1 connect_mode connect_2
!x1 0. 0. 77. dcyl1 1. tcyl1 .45
!x2 0. 0. 2.  dcyl2 3. tcyl2 .45 btype beam
!blname 6mwgeneric scale_mass 1. frac_stiff 1.

! new body that pitches with the blade root, given by the pitch controller
new_body  reftype  refnode   xfind   0.   0.  2.
rotorder 321       rotation  0.  0.  0.   axes normal !
name blade_2_pcontrol  parent blade_2_pitching

! blade 3
! blade_3_root - body coordinate system that does not pitch
new_body name blade_3_root parent hub reftype refnode xfind -1.8 0. 0.
rotorder 321 rotation -120.  -2.  0.   axes normal      ! dbg rotation -120. -2.   0.  ! cone

! blade_3_pitching - this body has coordinate system that pitches
new_body name blade_3_pitching parent blade_3_root reftype refnode
xfind 0. 0. 0. rotorder 321 rotation 0. 0. 0. axes normal ! pitch (z axis)

blade 3 pitch actuation blade 2 elements from here  ! useful for log file to pick out coordinates

copy_elements
from_body: blade_1_pitching
to_body:   blade_3_pitching

!new_elements_beam1  nelem 3  material hub connect_mode connect_2
!x1 0. 0. 2.  dcyl1 2.0 tcyl1 .1
!x2 0. 0. 0.  dcyl2 2.0 tcyl2 .1 btype beam

! from blade tip to root
!new_elements_beam1 nelem 10 material massless1 connect_mode connect_2
!x1 0. 0. 77. dcyl1 1. tcyl1 .45
```

```
!x2 0. 0. 2.  dcyl2 3. tcyl2 .45 btype beam
!blname 6mwgeneric scale_mass 1. frac_stiff 1.

! new body that pitches with the blade root, given by the pitch controller
new_body  reftype  refnode   xfind   0.   0.  2.
rotorder 321       rotation  0.  0.  0.   axes normal !
name blade_3_pcontrol  parent blade_3_pitching
! ------------------------------------------------------------------------------------------
!monitor_element_b1  type plot nmonitor 100
!file turb1.plot

!monitor_element_b1  type tecplot nmonitor 100
!file turb1.dat

monitor_element_b1 find  0.   0.   1.7250E+01  nmonitor 20  node 1 type moments
file tower_root_force.txt           label s1 s2 s3  tower_root_fx  tower_root_fy  tower_root_fz
monitor_element_b1 find  0.   0.   1.7250E+01  nmonitor 20  node 1 type moments
file tower_root_moment.txt      label s1 s2 s3  tower_root_mx  tower_root_my  tower_root_mz

monitor_element_b1 find  0. 0. 47.8  nmonitor 20  node 1 type forces
file tower_mid_force.txt  label s1 s2 s3 tower_mid_fx tower_mid_fy tower_mid_fz
monitor_element_b1 find  0. 0. 47.8  nmonitor 20  node 1 type moments
file tower_mid_moment.txt  label s1 s2 s3  tower_mid_mx  tower_mid_my  tower_mid_mz

monitor_element_b1 find  0. 0. -.5  nmonitor 10  node 1 type forces
file rotor_1_force.txt  body_name mainbearing label s1 s2 s3 shaft_fx shaft_fy shaft_fz
monitor_element_b1 find  0. 0. -.5  nmonitor 10  node 1 type moments
file rotor_1_moment.txt  body_name mainbearing label s1 s2 s3  shaft_mx  shaft_my  shaft_mz

monitor_element_b1 find  0. 0. 1.67  nmonitor 10  node 1 type forces
file blade_1_root_force.txt  body_name blade_1_root label s1 s2 s3 RootFxc1 RootFyc1 RootFzc1
monitor_element_b1 find  0. 0. 1.67  nmonitor 10  node 1 type forces
file blade_2_root_force.txt  body_name blade_2_root label s1 s2 s3 RootFxc2 RootFyc2 RootFzc2
```

monitor_element_b1 find 0. 0. 1.67 nmonitor 10 node 1 type forces

file blade_3_root_force.txt body_name blade_3_root label s1 s2 s3 RootFxc3 RootFyc3 RootFzc3

monitor_element_b1 find 0. 0. 1.67 nmonitor 10 node 1 type moments

file blade_1_root_moment.txt body_name blade_1_root label s1 s2 s3 RootMxc1 RootMyc1 RootMzc1

monitor_element_b1 find 0. 0. 1.67 nmonitor 10 node 1 type moments

file blade_2_root_moment.txt body_name blade_2_root label s1 s2 s3 RootMxc2 RootMyc2 RootMzc2

monitor_element_b1 find 0. 0. 1.67 nmonitor 10 node 1 type moments

file blade_3_root_moment.txt body_name blade_3_root label s1 s2 s3 RootMxc3 RootMyc3 RootMzc3

monitor_element_b1 type wind_fixed find -3.0616E-16 -2.5000E+00 9.5500E+01 nmonitor 1 node 2

file wind.txt body_name inertial label WindVxi WindVyi WindVzi

monitor_element_b1 find 0. 0. 77. nmonitor 10 node 1 type orientation

file blade_1_tipx.txt body_name blade_1_root label OoPDefl1 IPDefl1

monitor_element_b1 find 0. 0. 77. nmonitor 10 node 1 type orientation

file blade_2_tipx.txt body_name blade_2_root label OoPDefl2 IPDefl2

monitor_element_b1 find 0. 0. 77. nmonitor 10 node 1 type orientation

file blade_3_tipx.txt body_name blade_3_root label OoPDefl3 IPDefl3

! Elastic twist of blade tip

!

monitor_element_b1 find 0. 0. 76.95 nmonitor 10 node 1 type orientation

file blade_1_tiptwist.txt body_name blade_1_pcontrol label s1 s2 s3 s4 s5 s6 Twst_yx1

monitor_element_b1 find 0. 0. 76.95 nmonitor 10 node 1 type orientation

file blade_2_tiptwist.txt body_name blade_2_pcontrol label s1 s2 s3 s4 s5 s6 Twst_yx2

monitor_element_b1 find 0. 0. 76.95 nmonitor 10 node 1 type orientation

file blade_3_tiptwist.txt body_name blade_3_pcontrol label s1 s2 s3 s4 s5 s6 Twst_yx3

! Actual pitch angle measured at blade root

!

monitor_element_b1 find 0. 0. 2.75 nmonitor 10 node 1 type orientation

file blade_1_pitch.txt body_name blade_1_pitching label s1 s2 s3 s4 s5 s6 Pitch_yx1

monitor_element_b1 find 0. 0. 2.75 nmonitor 10 node 1 type orientation

file blade_2_pitch.txt body_name blade_2_pitching label s1 s2 s3 s4 s5 s6 Pitch_yx2

monitor_element_b1 find 0. 0. 2.75 nmonitor 10 node 1 type orientation

file blade_3_pitch.txt body_name blade_3_pitching label s1 s2 s3 s4 s5 s6 Pitch_yx3

monitor_element_b1 find 1.3 0. 0.   nmonitor 10 node 2 type moments   ! dbg

file lsshaft_bend.txt body_name hub label s1 s2 s3 s4 LSSGagMya LSSGagMza

! Yaw bearing forces in system following tower top

monitor_element_b1 find 0. 0. -1. nmonitor 5   node 2 type forces

file tower_top_force.txt body_name yawdrive label s1 s2 s3 YawBrFxp YawBrFyp YawBrFzp

monitor_element_b1 find 0. 0. -1. nmonitor 5   node 2 type moments

file tower_top_moment.txt body_name yawdrive label s1 s2 s3 YawBrMxp YawBrMyp YawBrMzp

monitor_element_b1 find 0. 0. 90.   nmonitor 10   node 1 type gather

file rotor_sensors.txt label rotor_gather   toffset 0.

sensors:

nfact: 1 source: WindVxi   scale: 1.   unit: [m/s] ! header as source label

nfact: 1 source: WindVyi   scale: 1.   unit: [m/s] !

nfact: 1 source: WindVzi   scale: 1.   unit: [m/s] !

nfact: 1 source: Vaxial_1   scale: 1.   unit: [m/s] !

nfact: 1 source: GenPwr_1   scale: 1.e-3 !   unit: [kW]   header: GenPwr   ! Automatically defined in 3df

nfact: 1 source: GenTq_1   scale: 1.e-3   unit: [kNm]

nfact: 1 source: GenEff_1   scale: 1.   unit: [kNm]

nfact: 1 source: Azimuth_1   scale: 57.295779513082323 unit: [deg] header: Azimuth ! 180./rpi

nfact: 1 source: RotSpeed_1   scale: 9.549296585513721   unit: [rpm] header: RotSpeed   ! 30./pi

nfact: 1 source: OoPDefl1   scale: 1.   unit: [m]   !

nfact: 1 source: OoPDefl2   scale: 1.   unit: [m]   !

nfact: 1 source: OoPDefl3   scale: 1.   unit: [m]   !

nfact: 1 source: IPDefl1   scale: 1.   unit: [m]   !

nfact: 1 source: IPDefl2 scale: 1. unit: [m] !

nfact: 1 source: IPDefl3 scale: 1. unit: [m] !

nfact: 1 source: Twst_yx1 scale: 57.295779513082323 unit: [deg] header: TwstDefl1

nfact: 1 source: Twst_yx2 scale: 57.295779513082323 unit: [deg] header: TwstDefl2

nfact: 1 source: Twst_yx3 scale: 57.295779513082323 unit: [deg] header: TwstDefl3

nfact: 1 source: BldPitch1_1 scale: -57.295779513082323 unit: [deg] header: BldPitch1 ! from control system

nfact: 1 source: Pitch_yx1 scale: 57.295779513082323 unit: [deg] ! measured structural respons

nfact: 1 source: Pitch_yx2 scale: 57.295779513082323 unit: [deg] ! note small angle approx.

nfact: 1 source: Pitch_yx3 scale: 57.295779513082323 unit: [deg]

nfact: 1 source: RootFxc1 scale: .001 unit: [kN]

nfact: 1 source: RootFxc2 scale: .001 unit: [kN]

nfact: 1 source: RootFxc3 scale: .001 unit: [kN]

nfact: 1 source: RootFyc1 scale: .001 unit: [kN]

nfact: 1 source: RootFyc2 scale: .001 unit: [kN]

nfact: 1 source: RootFyc3 scale: .001 unit: [kN]

nfact: 1 source: RootFzc1 scale: -.001 unit: [kN]

nfact: 1 source: RootFzc2 scale: -.001 unit: [kN]

nfact: 1 source: RootFzc3 scale: -.001 unit: [kN]

nfact: 1 source: RootMxc1 scale: .001 unit: [kNm]

nfact: 1 source: RootMxc2 scale: .001 unit: [kNm]

nfact: 1 source: RootMxc3 scale: .001 unit: [kNm]

nfact: 1 source: RootMyc1 scale: .001 unit: [kNm]

nfact: 1 source: RootMyc2 scale: .001 unit: [kNm]

nfact: 1 source: RootMyc3 scale: .001 unit: [kNm]

nfact: 1 source: RootMzc1 scale: .001 unit: [kNm]

nfact: 1 source: RootMzc2 scale: .001 unit: [kNm]

nfact: 1 source: RootMzc3 scale: .001 unit: [kNm]

nfact: 1 source: shaft_fx scale: -.001 unit: [kN]

nfact: 1 source: shaft_fy scale: -.001 unit: [kN]

nfact: 1 source: shaft_fz scale: -.001 unit: [kN]

nfact: 1 source: shaft_mx scale: -.001 unit: [kNm]

nfact: 1 source: shaft_my scale: -.001 unit: [kNm]

nfact: 1 source: shaft_mz scale: -.001 unit: [kNm]

nfact: 1 source: tower_root_fx scale: -.001 unit: [kN]

nfact: 1 source: tower_root_fy scale: -.001 unit: [kN]

nfact: 1 source: tower_root_fz scale: -.001 unit: [kN]

nfact: 1 source: tower_root_mx scale: -.001 unit: [kNm]

nfact: 1 source: tower_root_my scale: -.001 unit: [kNm]

nfact: 1 source: tower_root_mz scale: -.001 unit: [kNm]

nfact: 1 source: tower_mid_fx scale: -.001 unit: [kN]

nfact: 1 source: tower_mid_fy scale: -.001 unit: [kN]

nfact: 1 source: tower_mid_fz scale: -.001 unit: [kN]

nfact: 1 source: tower_mid_mx scale: -.001 unit: [kNm]

nfact: 1 source: tower_mid_my scale: -.001 unit: [kNm]

nfact: 1 source: tower_mid_mz scale: -.001 unit: [kNm]

nfact: 1 source: LSSGagMya scale: .001 unit: [kNm] !

nfact: 1 source: LSSGagMza scale: .001 unit: [kNm] !

nfact: 1 source: YawBrFxp scale: -.001 unit: [kN] ! Nacelle coord.syst.

nfact: 1 source: YawBrFyp scale: -.001 unit: [kN] !

nfact: 1 source: YawBrFzp scale: -.001 unit: [kN] !

nfact: 1 source: YawBrMxp scale: -.001 unit: [kNm] !

nfact: 1 source: YawBrMyp scale: -.001 unit: [kNm] !

nfact: 1 source: YawBrMzp scale: -.001 unit: [kNm] !

!wind_transient

0. 5. 0.

30. 5. 0.

40. 10. 0.

200. 10. 0.

! turbulence_info: C:\3dfloat\turbulence\turbsim\NTM_U12_I18.3_PL0.09\TurbSim.bts
!c:\turbulence\IEA_OC4_v1_18_u.txt

turbulence_box

turbulence: file

```
turbulence_info:  Z:\turbsim\Case2\TurbSim_Case2.bts  !c:\turbulence\IEA_OC4_v1_18_u.txt
turb_tstart:  0.
turb_intens:  0.19
turbulence_scaling: none
reference_node:   0. 0. 90.
reference_height:   98.2

rotor_wake
name:                   rotor_1
shaft_element_body:         mainbearing
shaft_element_position:      -1.4 0. 0.   ! expressed in body mainbearing system
rotating_node:              1
induction:                  all
logfile:                rotor_1.txt
nblades:                3
bladenames:                 blade_1_pitching
                    blade_2_pitching
                    blade_3_pitching
pitch_control_name:         5mw_floating
pitch_actuator_bodies:      blade_1_pitching
                    blade_2_pitching
                    blade_3_pitching
pitch_actuator_positons:    0. 0. 1.
                    0. 0. 1.
                    0. 0. 1.        ! expressed in body  blade_1_pitching system

pitchcontrol
control_type:    iea_oc3_floating    !_floating
name:           5mw_floating
scale_omega:     1.21            !  this controller has nominal 12.1 rpm. Modified to 10 rpm
scale_vaxial:    1.0
scale_pitchcoll:  -1.0
omeganom:       1.1519173063162573 ! not taken into account for the iea_oc3_floating controller
```

ti: 10.

gain: 1.

pitchref: 0.

aux: 1. 2. 3. 4. 5. 6. 7. 8. 9. 10.

tower_shadow type: potential

xfind: 0. 0. 13. dcyl: 9.7 cdn: 1.0 ! node in tower, diameter, drag

xfind: 0. 0. 30. dcyl: 8.9 cdn: 1.0 ! if linear all the way, two nodes are enough

xfind: 0. 0. 47.8 dcyl: 8. cdn: 1.0

xfind: 0. 0. 94.8 dcyl: 5.7 cdn: 1.0

\==

\\ End of Main Geometry

\==

\\Monitors

\----------

!monitor_element_b1 type plot nmonitor 100

!file turb1.plot

! Tecplot

!monitor_element_b1 type: tecplot nmonitor: 20 file: turb1.dat

monitor_element_b1 find 0.000 0.000 0.0 nmonitor 20 node 2 type waveheight_origin

file waves.txt label WaveElev

monitor_element_b1 find 0.000 0.000 0.0 nmonitor 20 node 2 type waveheight

file waves_atplatform.txt label WaveElev_platf

\ gathering partk - collects all results to one file

monitor_element_b1 find 0. 0. 0. nmonitor 20 body_name inertial node 1 type gather

file X_SIM_RES_ALL.txt label X_gather

sensors:

nfact: 1 source: WaveElev scale: 1. unit: [m] !

nfact: 1 source: Ptfm_xx scale: 57.295779513082323 unit: [deg] header: PtfmPitch

\==========

\\ End of Monitors

\==========

\\ Constraints

\----------

\ Define sea bed

apply_nodal_bc find 0. 0. 0. wall idofs 3 idofe 3 displ -97.01 1. dstat 0.01

\ Force equal point mass allowance and tolerances

apply_nodal_bc find: 0 0 -11.5 apply_force 0. 0. -8219340 0. 0. 0. tstart: 0. tend: 1000000.

\ Force equal point mass cylinder structure

apply_nodal_bc find: 0 0 -0.5 apply_force 0. 0. -3437000 0. 0. 0. tstart: 0. tend: 1000000.

\ Force equal point mass mechanical outfitting

apply_nodal_bc find: 0 0 -0.5 apply_force 0. 0. -1964000 0. 0. 0. tstart: 0. tend: 1000000.

!\\\----------Pitch test----------

!apply_nodal_bc find 0. 0. 0. apply_displ idofs 5 idofe 5 displ 0.08727 tstart: 0. tramp: 80. tend: 100.

!apply_nodal_bc find 0. 0. 0. apply_displ idofs 1 idofe 1 displ 0.0 tstart: 0. tend: 100.

!\\\----------Heave test----------

! Displacement to make heave decay test

!apply_nodal_bc find 0. 0. 0. apply_displ idofs 3 idofe 3 displ 1.234 tstart: 0. tramp: 80. tend: 100.

\ ----------

\ wind load applied as point loads

\ ----------

\ ----------

\ Anchors

\ ----------

! Anchor 1

apply_nodal_bc find -850.973 0 -95 apply_displ idofs 1 idofe 6 displ 0. 0. 0. 0. 0. 0.

! Anchor 2

apply_nodal_bc find 424.9865 -736.098210530871 -95 apply_displ idofs 1 idofe 3 displ 0. 0. 0.

! Anchor 3

apply_nodal_bc find 424.9865 736.098210530871 -95 apply_displ idofs 1 idofe 3 displ 0. 0. 0.

\==========

\\ End of Constraints

\----------

\----------

\ Simultation settings

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\ Nodal damping included to take into account that morrison elements are not frequecny dependent

add_node_damping find 0. 0. 0.88

1 1 0.

2 2 0.

3 3 200000

material_specific_damping material Chain type rayleigh alpha 0. beta 0.02

newmark dt 0.01 nassemble 1 nnewton: 20 nsubmin: 2 rwilson: 0.8 relax: 0.0 resid_newton: 1.e-8 nmonitor: 10

\ presteps with high damping

print_nodes

nodes.txt

-1 -1

```
print_b1_elements
elements.txt
-1  -1
 3 2 3 2

print_solution
solution.txt

damping type ratio2rayl  ratio_1 0.01  ratio_2 0.01  omega_1 0.1  omega_2 1.
!monitor_element_b1  type tecplot nmonitor 100
file turb1.dat

step nstep 400000 method step9 !new_gen_alpha

END
```