Web Application for Analysis of Dynamic Positioning System

help@floatdyn.com

The web application analyzes the given DP system to compute the limiting force the system can balance. Input to the application:

1. Capacity of individual thrusters
2. Coordinates of thrusters in plan

Please note that this program does not compute thruster capacity reduction of any sort. It is up to the user to compute those reductions and supply the resulting reduced thruster capacities to the web application.

Example 1. A vessel is fitted with four azymuthal thrusters and one tunnel thruster. Calculate the limiting wind rosette. The required data is given below:

Table 1. Azimuthal Thrusters: Capacities and Locations

Maximum Capacity (kip)	X Coordinate (ft)	Y Coordinate (ft)
35	-240	30
35	-240	-30
25	175	0
25	190	0

Table 2. Tunnel Thrusters: Capacities and Locations

Maximum Capacity (kip)	X Coordinate (ft)
25	215

Table 3. Steady Forces due to Wave and Current

Heading (deg)	Force X (kip)	Force Y (kip)	Moment Z (kip.ft)
0	-7.5	0.0	0.0
30	-9.3	-26.8	-116.0
60	-6.8	-49.1	-212.5
90	0.0	-63.9	-276.7
120	6.8	-49.1	-212.5
150	9.3	-26.8	-116.0
180	7.5	0.0	0.0
210	9.3	26.8	116.0
240	6.8	49.1	212.5
270	0.0	63.9	276.7
300	-6.8	49.1	212.5
330	-9.3	26.8	116.0

Table 4. Wind Force Coefficients

Heading (deg)	Force X (kip/kn^2)	Force Y (kip/kn^2)	Moment Z (kip.ft/kn^2)
0	-0.038	0.000	0.000
30	-0.032	-0.027	-0.197
60	-0.008	-0.102	-0.739
90	0.000	-0.123	-0.892
120	0.008	-0.102	-0.739
150	0.032	-0.027	-0.197
180	0.038	0.000	0.000
210	0.032	0.027	0.197
240	0.008	0.102	0.739
270	0.000	0.123	0.892
300	-0.008	0.102	0.739
330	-0.032	0.027	0.197

Solution: The application accepts two sets of forces. First set is constant. The second set is accompanied by a multiplication factor. The two force sets are added together to solve the DP system. The solution also gives the limiting value of the multiplication factor.

A DP system is required to counter steady forces originating from wave drift, current, and wind. In the given problem, the wave and current forces are given and we are required to calculate the margin to resist wind forces.

Let's take a sample direction, 150 deg. Look up wave and current forces in **Table 3** for 150 deg heading. The forces are {9.3, -26.8, -116.0}. Enter these numbers as shown in **Figure 1** below.

Next there is a slot for the multiplier. Leave multiplier as 1.0. Next enter wind coefficients for 150 deg heading which are {0.032, -0.027, -0.197}. These are actually wind forces due to unit wind speed.

Also enter azymuthal and tunnel thruster information from **Table 1** and **Table 2** in the app.

Click on the **Calculate** button.

The output contains thruster forces and orientations for the given force system. It also gives the limiting multiplier at the end of the output. We are interested in this factor. The limiting factor in this case is 2666.476. The limiting wind speed is the square root of this number i.e. 51.64 knot.

Repeat the above procedure for the remaining headings. A hash (#) at the beginning of a line in the thruster data removes that thruster from input. This helps in dealing with damage conditions in which one or more thrusters are removed from the calculations.

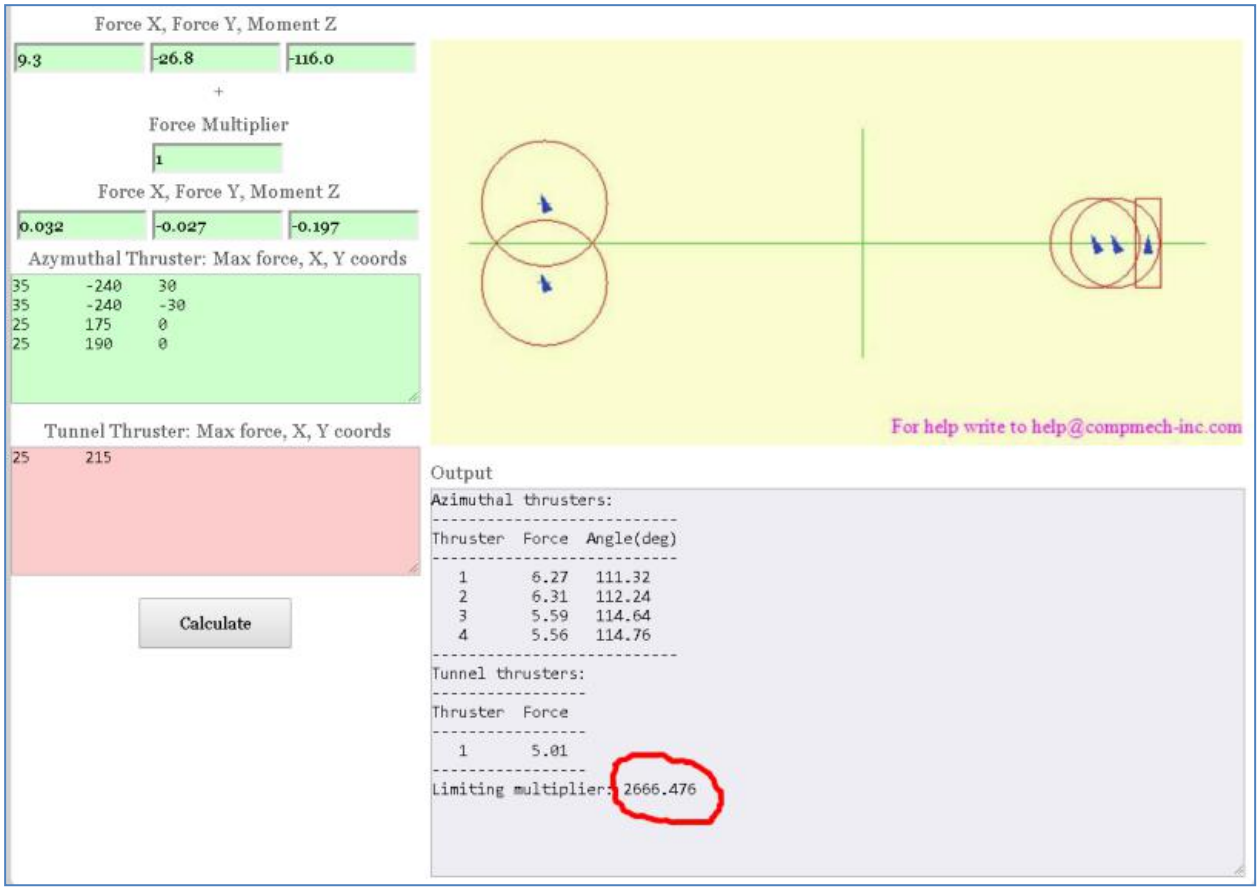

Figure 1. Screen Shot of Web Application

Table 5. Allowable Wind Speeds

Heading (deg)	Allowable Wind Speed (kn)
0	54.41
30	51.64
60	29.16
90	24.26
120	29.16
150	51.64
180	54.41
210	51.64
240	29.16
270	24.26
300	29.16
330	51.64

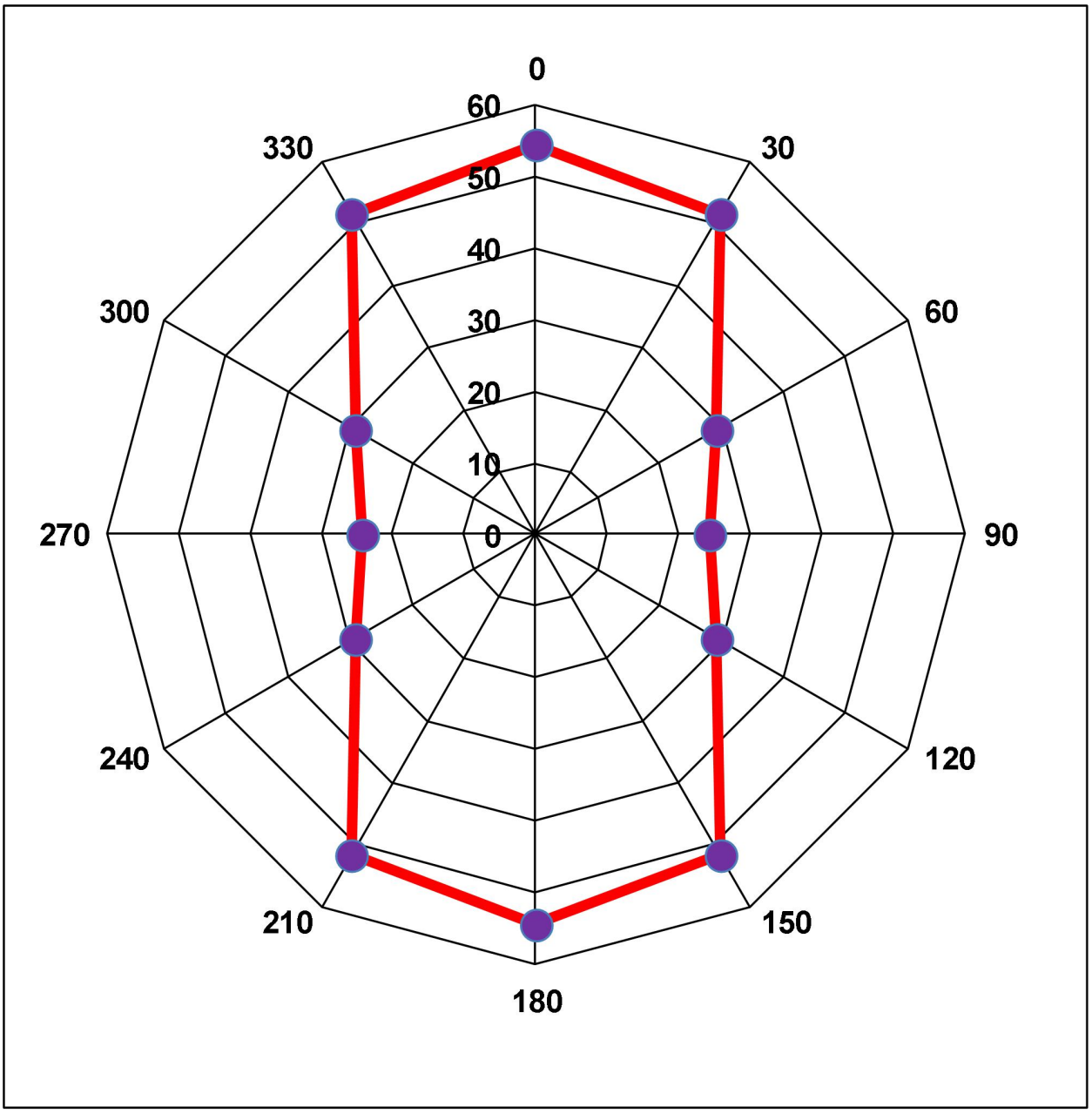

Figure 2. Allowable Wind Rosette