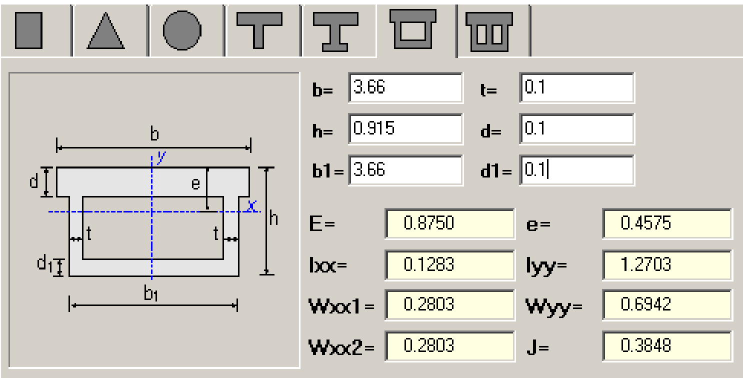
Example 002 (similar to Example 1 in metric system)

Design of a continuous breakwater with 6 pontoons. Each pontoon is 18.30 m long and has a cross section with width B=3.66m, height H=0.915m, thickness t=0.10 m, draft T=0.76 m. Mooring cables in the middle of each pontoon with a stiffness 49.18 kN/m. Wave spectrum of Pierson-Moskowitz type with peak wave period Ts=3 sec, and significant wave height Hs=0.76 m. Short crested waves with directional spectrum $S(f,\theta)= S(f) \cos^{n}(\theta-\theta_o)$ with n=2.
From Table 4.1, page 37 of the manual we get for n=2 α=4.5, β=1.9.
From the menu Tools/Cross Section Areas we compute the cross section values.

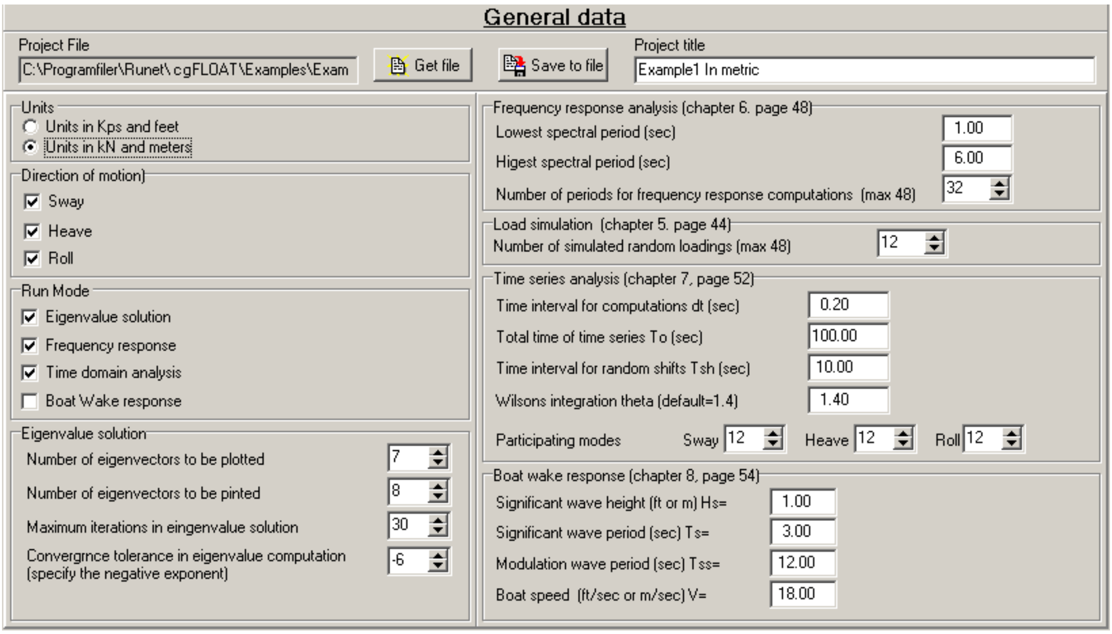


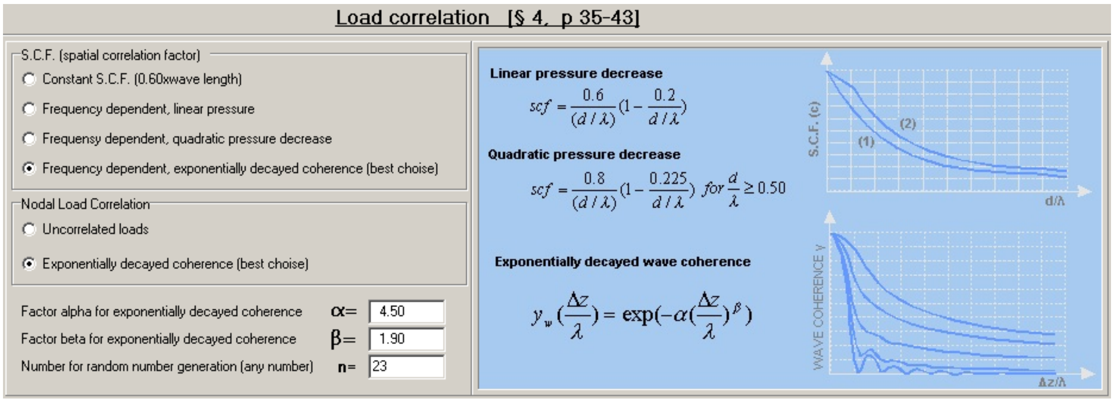
So we have Iyy=1.27 m4, Ixx=0.12 m4, A =0.875 m2, J=0.3859 m4, Io=Ixx+Iyy=1.39 m4
Mass (underwater part) mx = my =3.66x0.76x10/9.81 =2.83 Kg/m, mt=1.29x2.83/0.80=4.56 Kg m2/m
10 water specific weight, 9.81 acceleration of gravity)
For the hydrodynamic coefficients we use B=3.66, T=0.76, and pressing the Generate Values button we get the table according to the table 3.1 page 21 of the manual. (in the values of the added mass the structural mass is added)

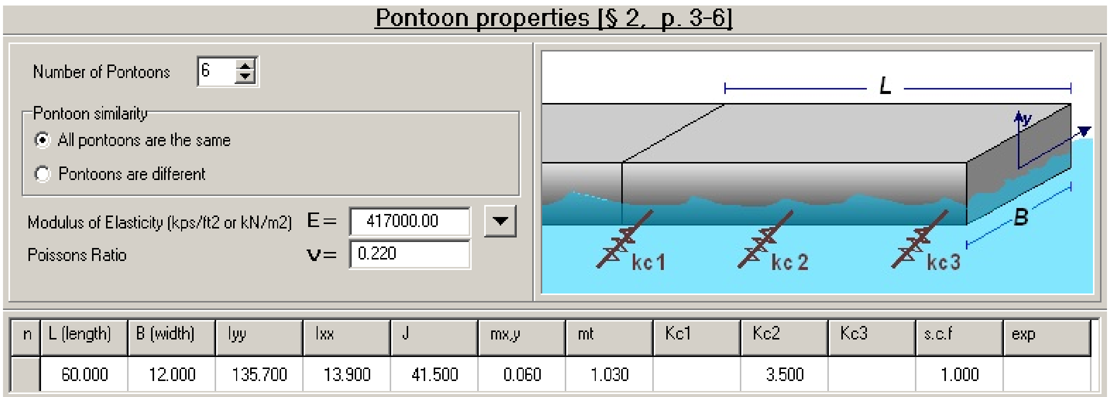
We complete the data in the pages of cgFLOAT as shown in the next pages. We use 8 random loading sets for the load simulation. Then we go in the last page Computations and Run Float. The FLOAT computational modulus is running and produces the output file. By pressing Output to Notepad we can see the output.

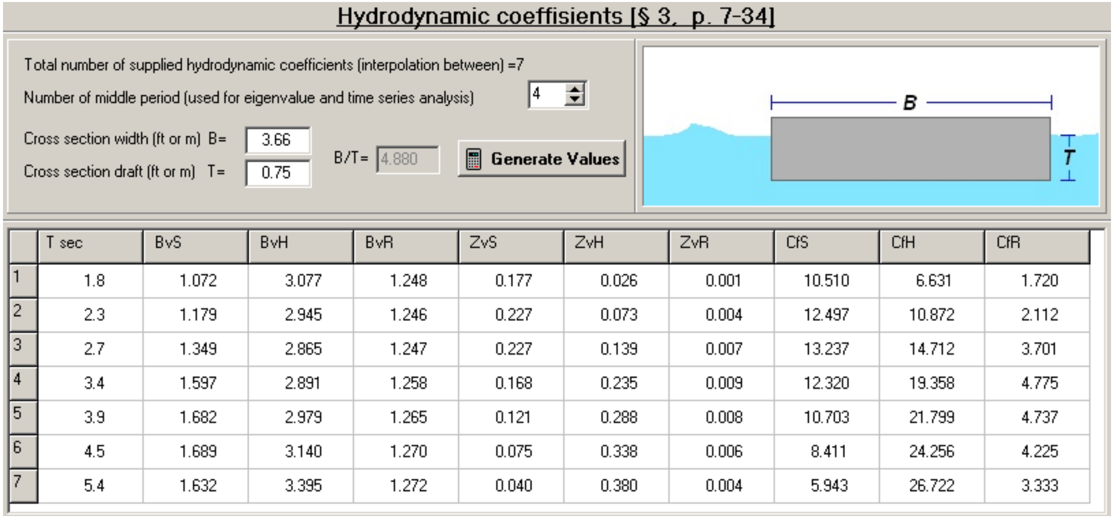
In the page Graphics you can see and print the graphical output of mode shapes and response values.

It is important to look in the output the displacements, bending moments and shear along the axis.
From the maximum displacement in sway we compute the mooring forces.
In the output we may also look at the response to unit amplitude harmonic waves. (we can see the difference in values due to the short crested waves)

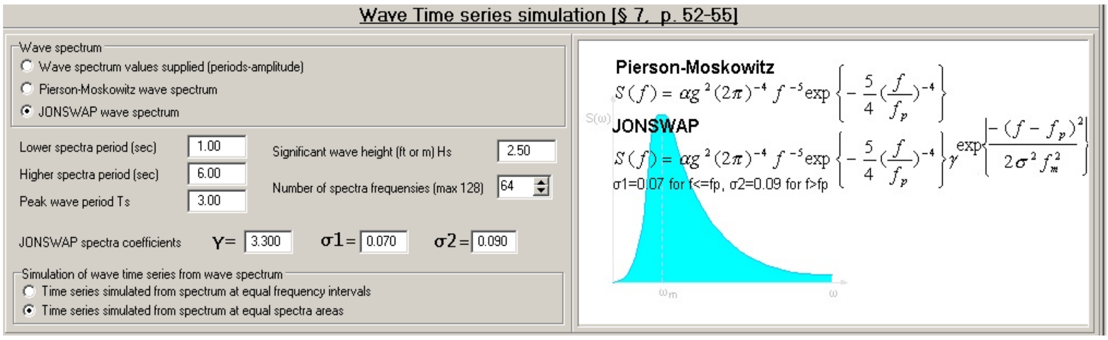

General data
Project File
C:\Programfiler\Runet\cgFLOAT\Examples\Exam
Get file
Save to file
Project title
Example1 In metric
Units
Units in Kps and feet
Units in kN and meters
Direction of motion
Sway
Heave
Roll
Run Mode
Eigenvalue solution
Frequency response
Time domain analysis
Boat Wake response
Eigenvalue solution
Number of eigenvectors to be plotted 7
Number of eigenvectors to be pinted 8
Maximum iterations in eingenvalue solution 30
Convergrnce tolerance in eigenvalue computation (specify the negative exponent) -6
Frequency response analysis (chapter 6. page 48)
Lowest spectral period (sec) 1.00
Higest spectral period (sec) 6.00
Number of periods for frequency response computations (max 48) 32
Load simulation (chapter 5. page 44)
Number of simulated random loadings (max 48) 12
Time series analysis (chapter 7, page 52)
Time interval for computations dt (sec) 0.20
Total time of time series To (sec) 100.00
Time interval for random shifts Tsh (sec) 10.00
Wilsons integration theta (default=1.4) 1.40
Participating modes Sway 12 Heave 12 Roll 12
Boat wake response (chapter 8, page 54)
Significant wave height (ft or m) Hs= 1.00
Significant wave period (sec) Ts= 3.00
Modulation wave period (sec) Tss= 12.00
Boat speed (ft/sec or m/sec) V= 18.00


Load correlation [§ 4, p 35-43]
S.C.F. (spatial correlation factor)
Constant S.C.F. (0.60xwave length)
Frequency dependent, linear pressure
Frequensy dependent, quadratic pressure decrease
Frequency dependent, exponentially decayed coherence (best choise)
Nodal Load Correlation
Uncorrelated loads
Exponentially decayed coherence (best choise)
Factor alpha for exponentially decayed coherence α= 4.50
Factor beta for exponentially decayed coherence β= 1.90
Number for random number generation (any number) n= 23
Linear pressure decrease
$scf = \frac{0.6}{(d/\lambda)}(1-\frac{0.2}{d/\lambda})$
Quadratic pressure decrease
$scf = \frac{0.8}{(d/\lambda)}(1-\frac{0.225}{d/\lambda})\ for\ \frac{d}{\lambda} \geq 0.50$
Exponentially decayed wave coherence
$y_w(\frac{\Delta z}{\lambda}) = \exp(-\alpha(\frac{\Delta z}{\lambda})^{\beta})$
S.C.F. (e)
(1)
(2)
d/λ
WAVE COHERENCE γ
Δz/λ


Pontoon properties [§ 2, p. 3-6]
Number of Pontoons 6
Pontoon similarity
All pontoons are the same
Pontoons are different
Modulus of Elasticity (kps/ft2 or kN/m2) E= 417000.00
Poissons Ratio ν= 0.220
L
y
B
kc1
kc2
kc3
n | L (length) | B (width) | Iyy | Ixx | J | mx,y | mt | Kc1 | Kc2 | Kc3 | s.c.f | exp
60.000 | 12.000 | 135.700 | 13.900 | 41.500 | 0.060 | 1.030 | | 3.500 | | 1.000 |

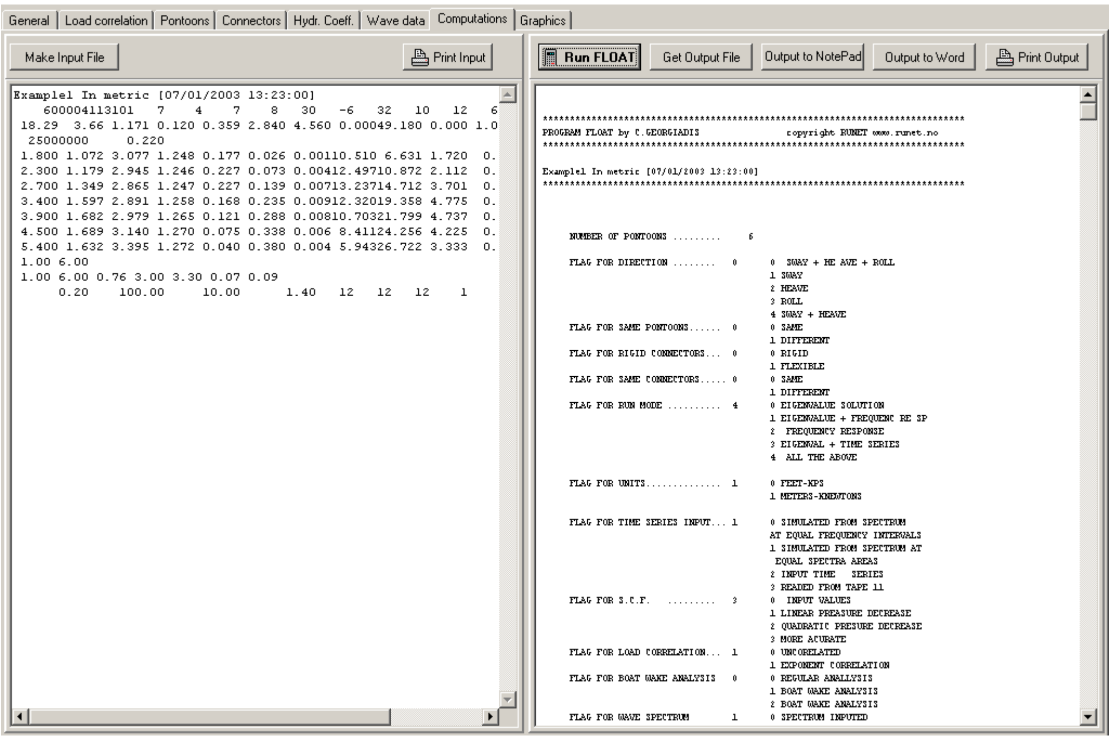


	T sec	BvS	BvH	BvR	ZvS	ZvH	ZvR	CfS	CfH	CfR
1	1.8	1.072	3.077	1.248	0.177	0.026	0.001	10.510	6.631	1.720
2	2.3	1.179	2.945	1.246	0.227	0.073	0.004	12.497	10.872	2.112
3	2.7	1.349	2.865	1.247	0.227	0.139	0.007	13.237	14.712	3.701
4	3.4	1.597	2.891	1.258	0.168	0.235	0.009	12.320	19.358	4.775
5	3.9	1.682	2.979	1.265	0.121	0.288	0.008	10.703	21.799	4.737
6	4.5	1.689	3.140	1.270	0.075	0.338	0.006	8.411	24.256	4.225
7	5.4	1.632	3.395	1.272	0.040	0.380	0.004	5.943	26.722	3.333



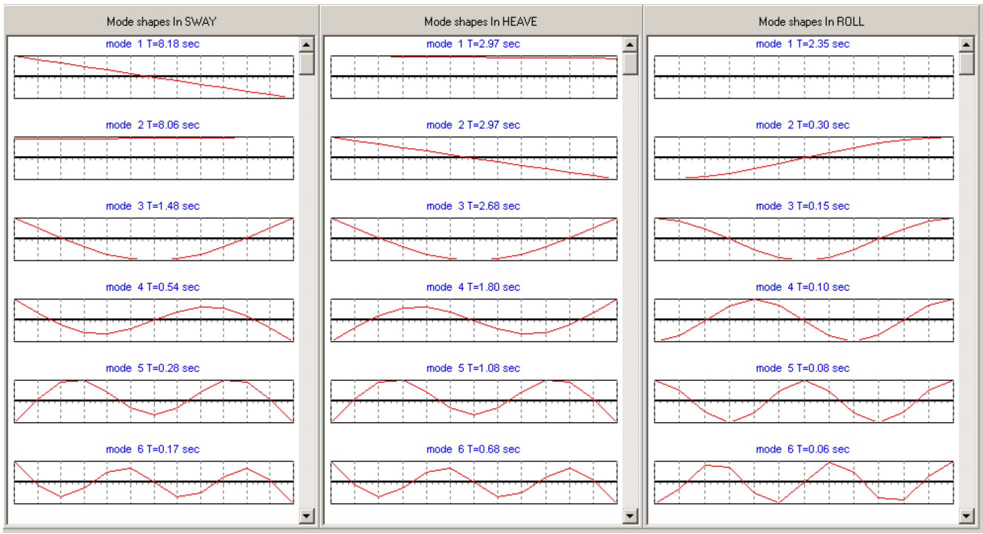
$$S(f) = \alpha g^2 (2\pi)^{-4} f^{-5} \exp\left\{-\frac{5}{4}\left(\frac{f}{f_p}\right)^{-4}\right\}$$

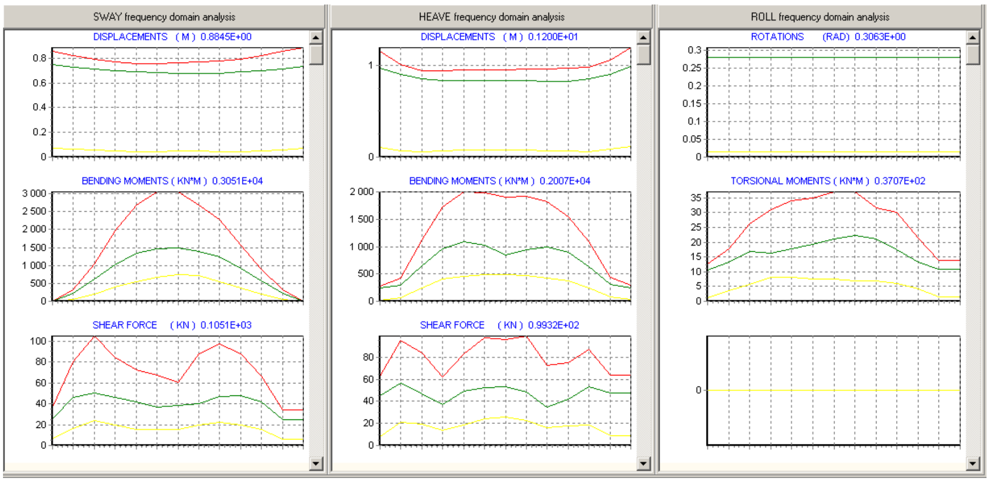
$$S(f) = \alpha g^2 (2\pi)^{-4} f^{-5} \exp\left\{-\frac{5}{4}\left(\frac{f}{f_p}\right)^{-4}\right\} \gamma^{\exp\left[\frac{-(f-f_p)^2}{2\sigma^2 f_m^2}\right]}$$

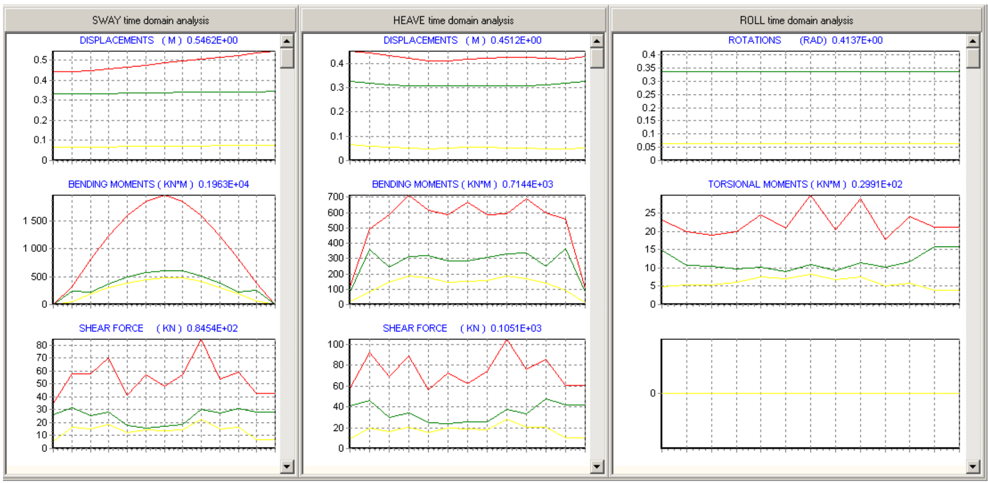



```
Example1 In metric [07/01/2003 13:23:00]
   600004113101    7    4    7    8   30   -6   32   10   12   6
 18.29  3.66 1.171 0.120 0.359 2.840 4.560 0.00049.180 0.000 1.0
  25000000     0.220
 1.800 1.072 3.077 1.248 0.177 0.026 0.00110.510 6.631 1.720  0.
 2.300 1.179 2.945 1.246 0.227 0.073 0.00412.49710.872 2.112  0.
 2.700 1.349 2.865 1.247 0.227 0.139 0.00713.23714.712 3.701  0.
 3.400 1.597 2.891 1.258 0.168 0.235 0.00912.32019.358 4.775  0.
 3.900 1.682 2.979 1.265 0.121 0.288 0.00810.70321.799 4.737  0.
 4.500 1.689 3.140 1.270 0.075 0.338 0.006 8.41124.256 4.225  0.
 5.400 1.632 3.395 1.272 0.040 0.380 0.004 5.94326.722 3.333  0.
 1.00 6.00
 1.00 6.00 0.76 3.00 3.30 0.07 0.09
      0.20    100.00      10.00      1.40   12   12   12    1
```

```
*******************************************************************************
PROGRAM FLOAT by C.GEORGIADIS              copyright RUNET www.runet.no
*******************************************************************************

Example1 In metric [07/01/2003 13:23:00]
*******************************************************************************

     NUMBER OF PONTOONS .........     6

     FLAG FOR DIRECTION ........   0      0  SWAY + HE AVE + ROLL
                                          1 SWAY
                                          2 HEAVE
                                          3 ROLL
                                          4 SWAY + HEAVE
     FLAG FOR SAME PONTOONS......  0      0 SAME
                                          1 DIFFERENT
     FLAG FOR RIGID CONNECTORS...  0      0 RIGID
                                          1 FLEXIBLE
     FLAG FOR SAME CONNECTORS..... 0      0 SAME
                                          1 DIFFERENT
     FLAG FOR RUN MODE ..........  4      0 EIGENVALUE SOLUTION
                                          1 EIGENVALUE + FREQUENC RE SP
                                          2  FREQUENCY RESPONSE
                                          3 EIGENVAL + TIME SERIES
                                          4  ALL THE ABOVE

     FLAG FOR UNITS.............   1      0 FEET-KPS
                                          1 METERS-KNEWTONS

     FLAG FOR TIME SERIES INPUT... 1      0 SIMULATED FROM SPECTRUM
                                          AT EQUAL FREQUENCY INTERVALS
                                          1 SIMULATED FROM SPECTRUM AT
                                           EQUAL SPECTRA AREAS
                                          2 INPUT TIME   SERIES
                                          3 READED FROM TAPE 11
     FLAG FOR S.C.F.   .........   3      0  INPUT VALUES
                                          1 LINEAR PREASURE DECREASE
                                          2 QUADRATIC PRESURE DECREASE
                                          3 MORE ACURATE
     FLAG FOR LOAD CORRELATION...  1      0 UNCORELATED
                                          1 EXPONENT CORRELATION
     FLAG FOR BOAT WAKE ANALYSIS   0      0 REGULAR ANALLYSIS
                                          1 BOAT WAKE ANALYSIS
                                          2 BOAT WAKE ANALYSIS
     FLAG FOR WAVE SPECTRUM        1      0 SPECTRUM INPUTED
```


Mode shapes In SWAY
mode 1 T=8.18 sec
mode 2 T=8.06 sec
mode 3 T=1.48 sec
mode 4 T=0.54 sec
mode 5 T=0.28 sec
mode 6 T=0.17 sec
Mode shapes In HEAVE
mode 1 T=2.97 sec
mode 2 T=2.97 sec
mode 3 T=2.68 sec
mode 4 T=1.80 sec
mode 5 T=1.08 sec
mode 6 T=0.68 sec
Mode shapes In ROLL
mode 1 T=2.35 sec
mode 2 T=0.30 sec
mode 3 T=0.15 sec
mode 4 T=0.10 sec
mode 5 T=0.08 sec
mode 6 T=0.06 sec


SWAY frequency domain analysis
DISPLACEMENTS (M) 0.8845E+00
BENDING MOMENTS (KN*M) 0.3051E+04
SHEAR FORCE (KN) 0.1051E+03
HEAVE frequency domain analysis
DISPLACEMENTS (M) 0.1200E+01
BENDING MOMENTS (KN*M) 0.2007E+04
SHEAR FORCE (KN) 0.9932E+02
ROLL frequency domain analysis
ROTATIONS (RAD) 0.3063E+00
TORSIONAL MOMENTS (KN*M) 0.3707E+02


SWAY time domain analysis
DISPLACEMENTS (M) 0.5462E+00
BENDING MOMENTS (KN*M) 0.1963E+04
SHEAR FORCE (KN) 0.8454E+02
HEAVE time domain analysis
DISPLACEMENTS (M) 0.4512E+00
BENDING MOMENTS (KN*M) 0.7144E+03
SHEAR FORCE (KN) 0.1051E+03
ROLL time domain analysis
ROTATIONS (RAD) 0.4137E+00
TORSIONAL MOMENTS (KN*M) 0.2991E+02