SIMBAD PROGRAM

Foreword

The SIMBAD numerical model can be used to simulate the behavior of a moored ship, using the Cummins equation (time simulation) and taking into account the following elements:

- Random wave forces (first order and drift forces)
- Gusty wind forces (generation of wind speeds according to a wind spectrum)
- Forces induced by a passing ship
- Linear or non-linear mooring characteristics for mooring lines and fenders, as well as rigid connection type mooring system

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The input data are read from the following files:

1. **Files provided by the pre-processing program (see documentation):**

- "Houl_irr.txt", for main characteristics of ship (length, draught, position of centre of gravity, masses and inertia, hydrostatics, "infinity" added masses…)
- "rad_IRF.txt", for the radiation damping impulse response functions
- "wave_for.txt" and "drift_for.txt" respectively for the wave excitation and drift forces time series
- "wind_vel.txt" for the wind speed time series

2. **Files specific for the SIMBAD numerical model:**

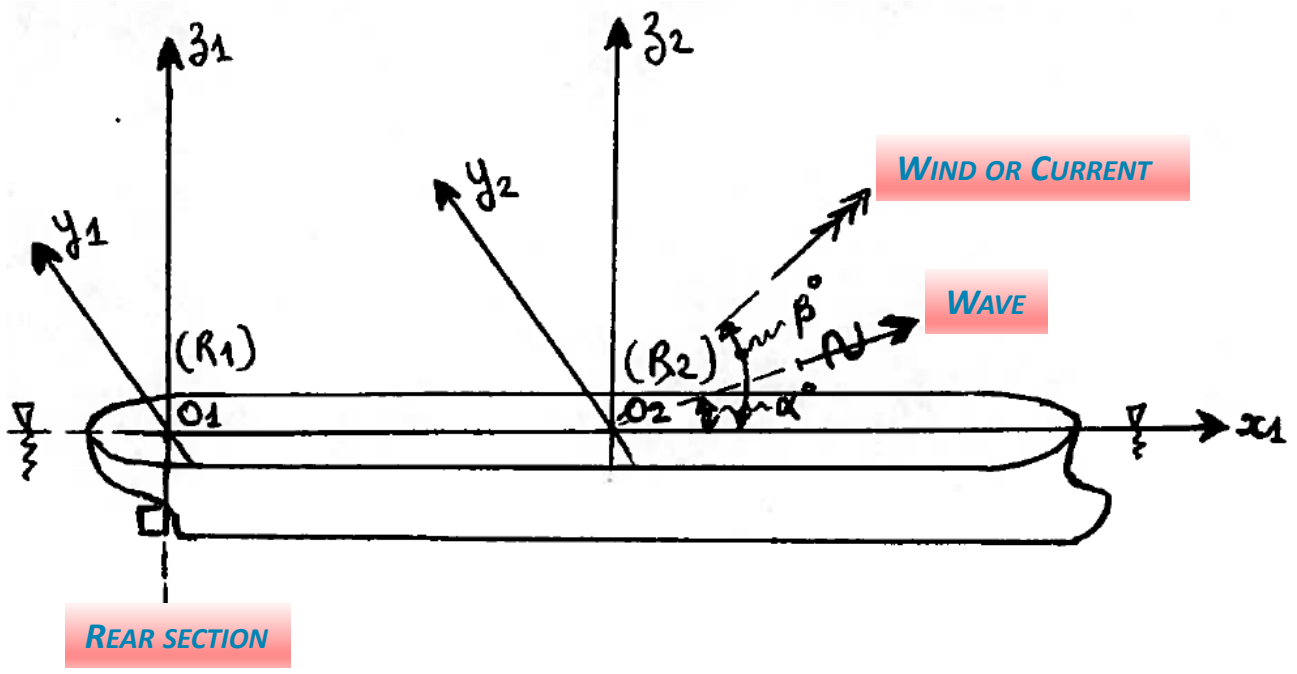
Unlike the previous files, the names of the following files can be changed at the beginning of each run, if necessary:

- "Vent.dat", for the wind characteristics (other than direction and velocity)
- "Courant.dat", for the current Characteristics
- "Amar.dat" for the mooring system
- "Point.dat" for a particular point aboard the ship
- "Chenal.dat" for passing ship induced forces

These files are described in details hereafter.

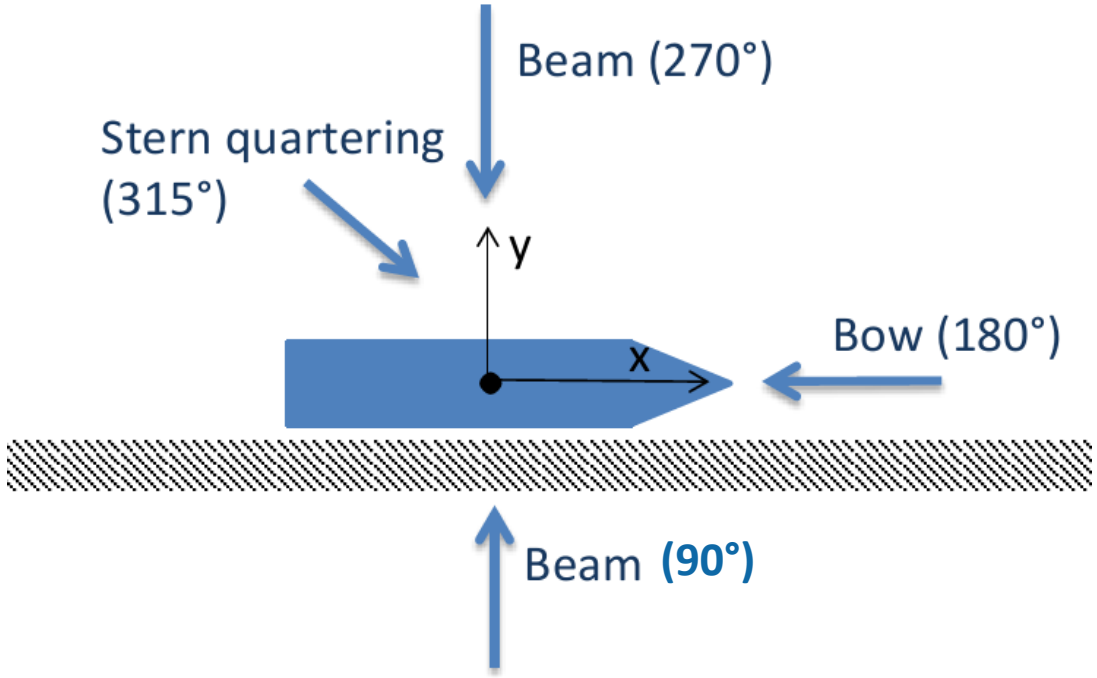
Coordinate systems:

Two coordinate systems are used in the SIMBAD program. These coordinate systems have the x axis pointing forward, y to port and z upward. The first fixed coordinate system (R1) has its origin located at the intersection of rear section, midship plane and waterline plane. The second coordinate system (R2) has its origin located at the position of the centre of gravity (with its x, y and z values specified as per the first coordinate system in file "Houl_irr.txt").

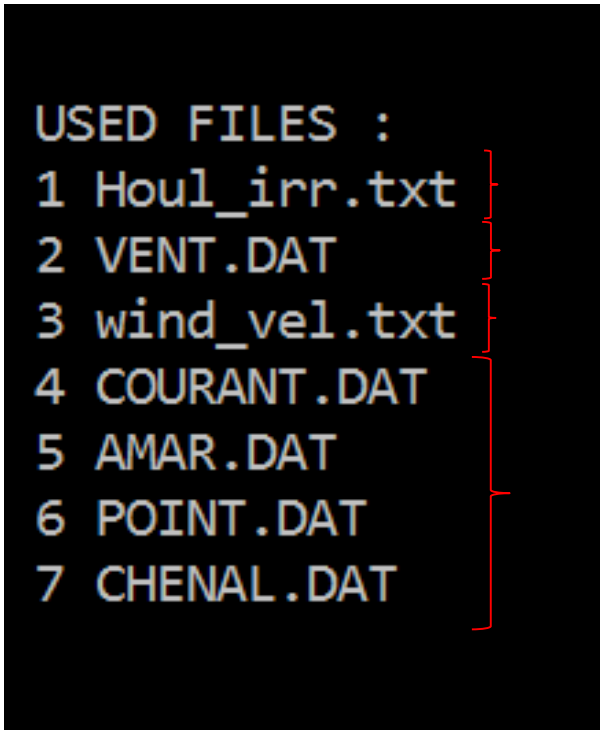


Relative directions of environmental conditions:

The relative direction has been defined in the ship axis system in which waves propagating, wind blowing or current flowing in the direction of the positive X2-axis is defined as 0° and waves propagating, wind blowing or current flowing in the positive Y2-axis as 90°



Running the SIMBAD program:
Names of input files at beginning of each run



Name of file not to be changed

Input file name that can be changed (File name:12 characters max. with extension)

Name of file not to be changed

Input file names that can be changed (File name:12 characters max. with extension)

Running the SIMBAD program:
Input file "wind_vel.txt" provides the wind velocity time series

```
   210.0000
0.00    10.22
2.00    13.02
4.00    16.32
6.00    18.22
8.00    20.16
10.00   19.90
12.00   19.19
14.00   23.30
16.00   18.96
18.00   19.95
20.00   22.05
22.00   16.86
24.00   18.02
26.00   13.48
28.00   15.77
30.00   20.65
32.00   18.27
34.00   18.07
36.00   19.52
38.00   16.74
40.00   18.35
42.00   16.90
44.00   15.13
46.00   20.91
48.00   17.20
50.00   20.08
52.00   20.88
54.00   17.19
56.00   17.49
58.00   16.30
60.00   19.09
62.00   22.00
64.00   17.98
66.00   13.65
    -
    -
    -
```

Relative wind direction

*Wind speed time series (time in s vs. wind speed in m/s). It is mandatory to end with a negative time value. The number of time steps is limited to **28800**. If the simulation time is greater than the duration of the time series, the series is repeated cyclically. The duration of time series shall be less than (or equal to) the total simulation time.*

RUNNING THE SIMBAD PROGRAM:
INPUT FILE "WIND_VEL.TXT" PROVIDES THE WIND VELOCITY TIME SERIES (FOLLOWING)

```
      -
      -
1968.00 17.69
1970.00 17.34
1972.00 21.37
1974.00 16.50
1976.00 19.60
1978.00 18.94
1980.00 15.30
1982.00 13.70
1984.00 10.65
1986.00 11.59
1988.00 16.70
1990.00 11.93
1992.00 10.10
1994.00 11.96
1996.00 10.55
         -1           0
```

*WIND SPEED TIME SERIES (TIME IN S VS. WIND SPEED IN M/S). IT IS MANDATORY TO END WITH A NEGATIVE TIME VALUE. THE NUMBER OF TIME STEPS IS LIMITED TO **28800**. IF THE SIMULATION TIME IS GREATER THAN THE DURATION OF THE TIME SERIES, THE SERIES IS REPEATED CYCLICALLY. THE DURATION OF TIME SERIES SHALL BE LESS THAN (OR EQUAL TO) THE TOTAL SIMULATION TIME.*

```
  123.0000
0.0000000E+00  0.0000000E+00
 10000.00      0.0000000E+00
         -1           0
```

WHEN THERE IS NO WIND, SUCH AN INPUT FILE WITH A NIL SPEED IS REQUIRED

RUNNING THE SIMBAD PROGRAM:
INPUT FILE "VENT.DAT" PROVIDES THE WIND CHARACTERISTICS

```
 5300.000       1320.000       274.0000       8.500000
0.0000000E+00  0.3500000      0.0000000E+00  0.0000000E+00  0.0000000E+00
 10.00000      0.3500000      0.1300000     -2.5000000E-02 -0.3300000
 20.00000      0.2500000      0.2900000     -2.9999999E-02 -0.5400000
 30.00000      0.2000000      0.4300000     -7.5000003E-02 -0.8200000
 40.00000      0.2100000      0.5500000     -9.0000004E-02  -1.080000
 50.00000      0.2600000      0.6300000     -0.1150000      -1.240000
 60.00000      0.3000000      0.6800000     -9.0000004E-02  -1.350000
 70.00000      0.2200000      0.7100000     -2.9999999E-02  -1.410000
 80.00000      0.1300000      0.7200000     -2.5000000E-02  -1.480000
 90.00000      0.0000000E+00  0.7200000      0.0000000E+00  -1.530000
 100.0000     -5.0000001E-02  0.7100000      1.5000000E-02  -1.490000
 110.0000     -7.9999998E-02  0.6800000      2.9999999E-02  -1.400000
 120.0000     -0.1000000      0.6400000      5.0000001E-02  -1.270000
 130.0000     -0.1500000      0.5500000      7.5000003E-02  -1.100000
 140.0000     -0.2000000      0.4300000      5.0000001E-02 -0.9100000
 150.0000     -0.2500000      0.3000000      3.9999999E-02 -0.6200000
 160.0000     -0.3000000      0.1900000      2.9999999E-02 -0.3800000
 170.0000     -0.3500000      9.0000004E-02  1.5000000E-02 -0.2200000
 180.0000     -0.4000000      0.0000000E+00  0.0000000E+00  0.0000000E+00
```

SIDE WIND AREA/FRONT WIND AREA/VESSEL LENGTH/HEIGHT OF SIDE WIND AREA CENTRE OF GRAVITY ABOVE THE WATERLINE PLANE

RELATIVE WIND DIRECTION (FROM 0° TO 180°) /WIND COEFFICIENTS CX, CY, CN, CK (SEE NOTE HEREAFTER)

NOTE ON THE WIND FORCES CALCULATION:

THE FOLLOWING FORMULAS ARE USED, RELATIVE TO COORDINATE SYSTEM R2:

SURGE WIND FORCE: $F_{xv} = \frac{1}{2} \rho_a \cdot C_x \cdot A_l \cdot V^2$

SWAY WIND FORCE: $F_{yv} = \frac{1}{2} \rho_a \cdot C_y \cdot A_T \cdot V^2$

YAW WIND MOMENT: $M_{nv} = \frac{1}{2} \rho_a \cdot C_n \cdot A_T \cdot V^2 \cdot L_{pp}$

ROLL WIND MOMENT: $M_{kv} = \frac{1}{2} \rho_a \cdot C_k \cdot A_T \cdot V^2 \cdot H$

WITH:

CX, CY, CN, CK: WIND COEFFICIENTS VS. RELATIVE DIRECTION

V, WIND SPEED (M/S)

AT, AL: SIDE WIND AND FRONT WIND AREAS (M2)

LPP: SHIP LENGTH (M)

H: HEIGHT OF SIDE WIND AREA CENTRE OF GRAVITY ABOVE THE WATERLINE PLAN

ρ_a*: AIR DENSITY (KG/M3)*

Running the SIMBAD program:
Input file "Courant.dat" provides the current characteristics

```
   180.0000
0.00    0.0
10000.0 0.0
-1           0
0        0.038   0        0
10       0.034   0.23     0.055
20       0.023   0.6      0.125
30       -0.037  0.91     0.17
40       -0.114  1.18     0.19
50       -0.114  1.37     0.175
60       -0.046  1.49     0.13
70       -0.02   1.58     0.08
80       -0.015  1.64     0.02
90       -0.02   1.68     -0.04
100      -0.024  1.66     -0.095
110      -0.01   1.61     -0.155
120      0.026   1.52     -0.21
130      0.067   1.4      -0.25
140      0.068   1.22     -0.265
150      0.04    0.99     -0.245
160      -0.009  0.69     -0.195
170      -0.031  0.32     -0.115
180      -0.035  0        0
```

Relative current direction

Current speed time series (time in s vs. current speed in m/s). Same convention as for the wind file

Relative current direction (from 0° to 180°) /Current coefficients Cx, Cy, Cm (see note hereafter)

When there is no current, such an input file with a nil speed is required

Note on the current forces calculation:

The following formulas are used, relative to coordinate system R2:

Surge wind force: $F = \frac{1}{2} \rho C_F U^2 A_c$

Sway wind force: $F = \frac{1}{2} \rho C_F U^2 A_c$

Yaw wind moment: $M = \frac{1}{2} \rho C_M U^2 A_c L_{pp}$

with:

Cf = Cx , Cy: Current coefficients in surge or sway vs. relative direction

Cm = Current coefficients in yaw vs. relative direction

U, current speed (m/s)

Ac: Current area (m2) = Lpp x T

Lpp: ship length (m)

T: ship draft (m)

p: water density (kg/m3)

Running the SIMBAD program:
Input file "Amar.dat" defines the mooring system

```
          12
           1           4   336500.0  -188320.0  82873.0  -7786.7
           1  0.0000000E+00
   -66.000       65.50000        7.50000
   -15.0000       5.00000        22.0000
   98100.0      0.0000000E+00
           1           4   596520.0  -415490.0  186330.0  -18592.0
           1  0.0000000E+00
   -21.0000       65.50000        7.50000
   -6.0000        16.50000       22.00000
  147200.0      0.0000000E+00
           1           4   394520.0  -272190.0  121920.0  -12132.0
           1  0.0000000E+00
  25.00000       65.50000        7.50000
   1.50000       18.50000       22.00000
  123600.0      0.0000000E+00
           1           4   358580.0  -219240.0  97027.0  -9332.8
           1  0.0000000E+00
   93.0000       29.00000        7.50000
   25.0000       23.00000       22.00000
  129500.0      0.0000000E+00
           1           4   354470.0  -213390.0  94326.0  -9034.9
           1  0.0000000E+00
  151.0000       29.00000        7.50000
  221.0000       23.00000       22.00000
   68700.0      0.0000000E+00
           1           4   375670.0  -244040.0  108590.0  -10621.0
           1  0.0000000E+00
  221.0000       65.50000        7.50000
  252.0000       13.50000       22.00000
   88300.0      0.0000000E+00
           1           4   580970.0  -391990.0  175120.0  -17314.0
           1  0.0000000E+00
  263.0000       65.50000        7.50000
  262.0000       10.00000       22.00000
  132400.0      0.0000000E+00
           1           4   352330.0  -210370.0  92935.0  -8882.0
```

Total number of mooring lines and fenders. Max.: 22

Each mooring line or fender defined as follows:

First line:

Parameter for the type of connection: 1 for a classic mooring line, 2 for a specific connection, -1 for a fender

For classic mooring line and fender (parameters 1 and -1), the stiffness may be defined with a polynomial curve up to degree 5, defining the mooring load as a function of elongation or the reaction force as a function of deflection, such as:

$A * x + B * x^2 + C * x^3 + D * x^4$ *(x being the elongation or deflection), then for a strong non-linear stiffness: indicate (degree) 4 (and coefficients:) A (N/m), B(N/m2),C(N/m3),D(N/m4) and for a linear stiffness: (degree) 1 (and) A(N/m)*

A specific connection (parameter 2) is a unit that responds to the error in displacement (x and y directions) with a reaction force with the aim of getting the unit, and thus the ship, back in the neutral position. The model of the units is written to calculate the angle and magnitude of this reaction force. The error in displacement is run through a PID controller. The control value and the angle, defining the maximum force, are used to determine the maximum force. In any case, to prevent the forces larger than the maximum force, the control variable has a maximum of 1. Each unit is allocated to exert a sway force of 230 kN and a surge force of 100 kN. For this specific connection, the number indicating the degree of the polynomial is now the number of coupled units. It must be followed by as many nil values as there are number of units (example: 2 / 0. / 0.)

Running the SIMBAD program:
Input file "Amar.dat" defines the mooring system (following)

```
          12
           1           4   336500.0  -188320.0  82873.0  -7786.7
           1  0.0000000E+00
   -66.000       65.50000        7.50000
   -15.0000       5.00000        22.0000
   98100.0      0.0000000E+00
           1           4   596520.0  -415490.0  186330.0  -18592.0
           1  0.0000000E+00
   -21.0000       65.50000        7.50000
   -6.0000        16.50000       22.00000
  147200.0      0.0000000E+00
           1           4   394520.0  -272190.0  121920.0  -12132.0
           1  0.0000000E+00
  25.00000       65.50000        7.50000
   1.50000       18.50000       22.00000
  123600.0      0.0000000E+00
           1           4   358580.0  -219240.0  97027.0  -9332.8
           1  0.0000000E+00
   93.0000       29.00000        7.50000
   25.0000       23.00000       22.00000
  129500.0      0.0000000E+00
           1           4   354470.0  -213390.0  94326.0  -9034.9
           1  0.0000000E+00
  151.0000       29.00000        7.50000
  221.0000       23.00000       22.00000
   68700.0      0.0000000E+00
           1           4   375670.0  -244040.0  108590.0  -10621.0
           1  0.0000000E+00
  221.0000       65.50000        7.50000
  252.0000       13.50000       22.00000
   88300.0      0.0000000E+00
           1           4   580970.0  -391990.0  175120.0  -17314.0
           1  0.0000000E+00
  263.0000       65.50000        7.50000
  262.0000       10.00000       22.00000
  132400.0      0.0000000E+00
           1           4   352330.0  -210370.0  92935.0  -8882.0
```

Each mooring line or fender defined as follows:

Second line:

A damping may be defined with a polynomial curve up to degree 5, as a function of elongation or deflection speed. Conventions are the same as for the introduction of stiffness. If there is no damping: put 1/ 0.

Third line:

Position of the bollard at quay (parameter 1) or of fender support (generally the quay or wharf)(parameter -1), in the first fixed coordinate system (R1). For a specific connection (parameter 2), it is the point on the ship's hull where the connection is fixed.

Fourth line:

Position of the mooring point on-board the ship (parameter 1). If there is a long mooring length on-board the ship, it is preferable to position the point at the fairlead and to take this length into account in the calculation of the stiffness.

For a fender (parameter -1), it is the point on the ship's hull where the fender is in touch. Only the Y coordinates are different between the two positions.

For a specific connection (parameter 2), only the Y coordinate differs from the previous point and it should be placed 1 m in front of this point.

Fifth line:

Pretension (in N) for the mooring line and pre-damping, if any.

RUNNING THE SIMBAD PROGRAM:
INPUT FILE "AMAR.DAT" DEFINES THE MOORING SYSTEM (FOLLOWING)

```
        -1           1   8675000.
         1  0.0000000E+00
  68.0000       26.00000       5.000000
  68.0000       23.00000       5.000000
0.0000000E+00  0.0000000E+00
        -1           1   8675000.
         1  0.0000000E+00
  93.0000       26.00000       5.000000
  93.0000       23.00000       5.000000
0.0000000E+00  0.0000000E+00
        -1           1   8675000.
         1  0.0000000E+00
 151.0000       26.00000       5.000000
 151.0000       23.00000       5.000000
0.0000000E+00  0.0000000E+00
        -1           1   8675000.
         1  0.0000000E+00
 185.0000       26.00000       5.000000
 185.0000       23.00000       5.000000
0.0000000E+00  0.0000000E+00
        2           2   0.0 0.0
        1  0.0000000E+00
  72.9000      -15.95000       3.000000
  72.9000      -14.95000       3.000000
   0.0     0.0000000E+00
        2           2   0.0 0.0
        1  0.0000000E+00
 102.9000      -15.95000       3.000000
 102.9000      -14.95000       3.000000
   0.0     0.0000000E+00
        2           2   0.0 0.0
        1  0.0000000E+00
 132.9000      -15.95000       3.000000
 132.9000      -14.95000       3.000000
   0.0     0.0000000E+00
        2           2   0.0 0.0
        1  0.0000000E+00
 162.9000      -15.95000       3.000000
 162.9000      -14.95000       3.000000
   0.0     0.0000000E+00
```

EXAMPLES OF FENDER SYSTEM DEFINITION

EXAMPLES OF SPECIFIC CONNECTION DEFINITION

RUNNING THE SIMBAD PROGRAM:
INPUT FILE "POINT.DAT" FOR PARTICULAR POINTS ABOARD THE SHIP

```
          1
148.000         23.0000         26.2500
```

NUMBER OF PARTICULAR POINTS AND COORDINATES OF EACH POINT IN THE FIRST FIXED COORDINATE SYSTEM (R1)

Running the SIMBAD program:
Input file "Chenal.dat" for a passing ship

```
0.0     0.0     0.0     0.0
200.0   0.0     0.0     0.0
204.49  4175.07 0.0     0.0
208.97  5365.54 0.0     0.0
213.46  7155.45 422.6   0.0
217.94  8945.37 1056.5  0.0
222.43  9540.61 1687.7  0.0
226.92  14310.91 2110.3 0.0
231.40  17291.29 2427.3 0.0
235.89  20271.68 2532.9 0.0
240.38  22656.83 2744.2 0.0
244.86  28621.82 5065.9 0.0
249.35  31006.97 6333.7 -81054.8
253.83  36372.51 6967.6 -188933.6
258.32  42928.51 9923.2 -350897.5
262.81  52469.12 13090.1 -701940.7
267.29  59624.57 16888.1 -971929.2
271.78  67375.26 23010.5 -1349796.3
276.27  77515.32 28921.6 -1835833.8
280.75  87651.16 36945.8 -2348695.2
285.24  95401.84 49401.9 -2969581.1
289.72  102557.30 62489.1 -3779546.3
294.21  96592.31 80222.4 -4400432.2
298.70  82880.85 97113.3 -5075403.3
303.18  48298.27 111891.0 -5129342.6
307.67   7155.45 122445.4 -4589365.8
312.15  -54854.27 128567.8 -3320624.3
316.64  -115078.29 127514.0 -1619784.7
321.13  -172912.94 118224.7 944813.7
325.61  -232541.73 103024.4 4049534.7
330.10  -292166.30 86344.8 6992146.1
334.59  -345830.10 61224.1 9286901.9
339.07  -390548.53 27445.2 11338639.0
343.56  -414995.28 -12667.4 12958423.7
348.04  -419170.35 -55313.0 14038231.6
352.53  -413205.36 -97113.3 14389274.9
357.02  -392933.68 -143556.8 13714303.8

540.95  -11330.53 0.0 0.0
545.44  -9540.61 0.0 0.0
549.92  -7750.69 0.0 0.0
554.41  -6560.22 0.0 0.0
558.89  -4770.30 0.0 0.0
600.00  0.0 0.0 0.0
 -1    0.0  0.0  0.0
```

Time series of forces induced by passing ship relative to coordinate system R2 (surge force X, sway force Y in Newton and yaw moment M in Nm). It is mandatory to end with a negative time value. The number of time steps is limited to 1000. As there is no ramp-up time for this type of simulation, a "blank time" of about 200s is to be introduced at the beginning of the time series.

RUNNING THE SIMBAD PROGRAM (SIMBAD_V0.EXE):

```
USED FILES :
1 Houl_irr.txt
2 VENT.DAT
3 wind_vel.txt
4 COURANT.DAT
5 AMAR.DAT
6 POINT.DAT
7 CHENAL.DAT


MODIFICATION OF FILE? (YES:1 - NO:0)
0
INITIAL LENGTH:
          1   80.4456329
INITIAL LENGTH:
          2   53.2564545
INITIAL LENGTH:
          3   54.5114670
INITIAL LENGTH:
          4   69.7871780
INITIAL LENGTH:
          5   71.7373657
INITIAL LENGTH:
          6   62.2515068
INITIAL LENGTH:
          7   57.3715973
INITIAL LENGTH:
          8   72.6945648
INITIAL LENGTH:
          9   3.00000000
INITIAL LENGTH:
         10   3.00000000
INITIAL LENGTH:
         11   3.00000000
INITIAL LENGTH:
         12   3.00000000
TITLE ?

TOTAL SIMULATION TIME (IN SECONDS)?
     14399.50
TIME STEP (IN SECOND)?
   0.2000
RAMP-UP TIME (IN SECONDS) ?
400
```

RECALL OF THE NAME OF THE FILES. IF ONE NAME OF FILE IS WRONG OR ONE FILE IS NOT EXISTING IN THE DIRECTORY, THE PROGRAM ASKS FOR THE NAME OF THE FILE.

POSSIBLE CHANGE OF ONE NAME OF THE INPUT FILES

WRITING OF THE INITIAL LENGTHS OF MOORING LINES AND FENDERS

POSSIBLE WRITING OF A TITLE IN OUTPUT RESULT FILE
THE TOTAL SIMULATION TIME AND TIME STEP ARE FIXED BY THE HYDRODYNAMIC TIME SERIES
THE RAMP-UP TIME IS TO BE INTRODUCED (GENERALLY 400S)

RUNNING THE SIMBAD PROGRAM (SIMBAD_V0.EXE):

```
 TOTAL SIMULATION TIME (IN SECONDS)?
   14399.5000
 TIME STEP (IN SECOND)?
  0.200000003
 RAMP-UP TIME (IN SECONDS) ?
400
 *** CALCULATION IN PROGRESS ***



 0 ---> PROGRAM EXIT
 1 ---> WRITING OF RESULTS FILES
 2 ---> ADDITIONAL DURATION
 3 ---> ANALYSIS OF RESULTS


3
 START OF ANALYSIS (IN SECONDS)?
400
 END OF ANALYSIS (IN SECONDS)?
14300



 0 ---> PROGRAM EXIT
 1 ---> ANALYSIS: TABLE OF RESULTS


1


 ------------------------------------------------------------------------------
|            |   AVERAGE   |    MIN.     |    MAX.     |   MAX-MIN   |    RMS     |
 ------------------------------------------------------------------------------
| WIND  (M/S) |  1.702E+01 |  8.710E+00 |  2.497E+01 |  1.626E+01 |  2.643E+00 |
 ------------------------------------------------------------------------------
| SURGE (M)   | -5.064E-01 | -2.709E+00 |  1.230E+00 |  3.939E+00 |  5.872E-01 |
 ------------------------------------------------------------------------------
| SWAY  (M)   | -2.027E-01 | -8.676E-01 |  1.818E-01 |  1.049E+00 |  1.734E-01 |
 ------------------------------------------------------------------------------
| HEAVE (M)   | -2.849E-03 | -5.223E-01 |  5.201E-01 |  1.042E+00 |  1.167E-01 |
 ------------------------------------------------------------------------------
| ROLL  (DEG) | -1.463E-01 | -1.471E+00 |  1.132E+00 |  2.603E+00 |  3.491E-01 |
 ------------------------------------------------------------------------------
| PITCH (DEG) | -9.075E-04 | -7.916E-01 |  7.733E-01 |  1.565E+00 |  1.923E-01 |
 ------------------------------------------------------------------------------
```

CHOICE OF DIFFERENT OPTIONS (0 IS ALWAYS TO EXIT)

IF OPTION 3 IS CHOSEN ("ANALYSIS OF RESULTS"), THE START AND END TIME OF THE ANALYSIS ARE REQUESTED. FOR THE END TIME, ALWAYS INDICATE A TIME WHICH IS SHORTER (ABOUT 100S) THAN THE REAL END TIME. TO OBTAIN THE RESULTS OF THE ANALYSIS ON THE SCREEN ("RESUL.RES" FILE), TAKE OPTION 1 ("ANALYSIS: TABLE OF RESULTS")

Running the SIMBAD program:
Output file "Resul.res" for analysis of SIMBAD results

	AVERAGE	MIN.	MAX.	MAX-MIN	RMS
WIND (M/S)	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
SURGE (M)	9.676E-03	-4.941E-02	7.246E-02	1.219E-01	1.924E-02
SWAY (M)	-2.753E-01	-2.676E+00	1.120E+00	3.796E+00	5.058E-01
HEAVE (M)	-1.452E-03	-1.281E+00	1.381E+00	2.662E+00	3.387E-01
ROLL (DEG)	-1.201E-01	-3.810E+00	3.443E+00	7.254E+00	9.614E-01
PITCH (DEG)	1.493E-03	-3.463E-02	4.147E-02	7.609E-02	1.025E-02
YAW (DEG)	-4.091E-02	-4.943E-01	3.937E-01	8.880E-01	1.210E-01
POINT 1 :					
SURGE (M)	2.239E-02	-1.376E-01	1.872E-01	3.248E-01	4.344E-02
SWAY (M)	-2.484E-01	-2.801E+00	1.318E+00	4.119E+00	5.355E-01
HEAVE (M)	-3.842E-02	-1.371E+00	1.237E+00	2.608E+00	3.055E-01
TENSION :					
LINE 1 (T)	3.118E+01	0.000E+00	1.121E+02	1.121E+02	1.631E+01
LINE 2 (T)	3.187E+01	0.000E+00	1.184E+02	1.184E+02	1.763E+01
LINE 3 (T)	3.126E+01	0.000E+00	1.138E+02	1.138E+02	1.665E+01
LINE 4 (T)	2.588E+01	1.799E+01	4.229E+01	2.430E+01	2.895E+00
LINE 5 (T)	2.823E+01	1.655E+01	5.038E+01	3.382E+01	3.922E+00

Determination of average, minimum, maximum and standard deviation values for motions, mooring line and fender loads. By convention, mooring line loads are positive and fender loads are negative.

	PERIOD 1 (S)	AMPLITUDE 1	PERIOD 2 (S)	AMPLITUDE 2
WIND (M/S)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
SURGE (M)	8.436E+01	2.660E-02	7.816E+01	2.349E-02
SWAY (M)	2.986E+01	5.954E-01	1.427E+01	5.270E-01
HEAVE (M)	1.518E+01	4.266E-01	1.010E+01	3.629E-01
ROLL (DEG)	1.518E+01	1.639E+00	1.427E+01	1.364E+00
PITCH (DEG)	1.010E+01	1.574E-02	1.034E+01	9.014E-03
YAW (DEG)	2.988E+01	5.421E-01	2.610E+01	2.226E-01
POINT 1 :				
SURGE (M)	2.988E+01	1.821E-01	2.611E+01	7.044E-02
SWAY (M)	1.427E+01	6.347E-01	1.518E+01	5.984E-01
HEAVE (M)	1.518E+01	2.883E-01	1.701E+01	2.803E-01
TENSION :				
LINE 1 (T)	1.518E+01	1.858E+01	1.427E+01	1.445E+01
LINE 2 (T)	1.518E+01	2.042E+01	1.427E+01	1.623E+01

Determination of main periods and amplitudes of time-series from a FFT procedure

Other raw output files are also available for later analysis (see hereafter): motions, speeds, accelerations of the center of gravity or of a specific point; mooring line and fender loads.

RUNNING THE SIMBAD PROGRAM (SIMBAD_V0.EXE):

CHOICE OF DIFFERENT OPTIONS (0 IS ALWAYS TO EXIT)

IF OPTION 1 IS CHOSEN, CHOICE OF WRITING RAW OUTPUT FILES:
LINES.RES *FOR MOORING LINE AND FENDER LOADS,* ***MOVCG.RES*** *FOR CENTER OF GRAVITY MOTIONS,* ***MOVPT 1.RES*** *FOR MOTIONS OF S SPECIFIC POINT…*

RUNNING THE SIMBAD PROGRAM (SIMBAD_V0.EXE):

```
 0 ---> NO FILE WRITING
 1 ---> CENTER OF GRAVITY MOTIONS
 2 ---> CENTER OF GRAVITY VELOCITIES
 3 ---> CENTER OF GRAVITY ACCELERATIONS
 4 ---> MOTIONS OF A SPECIFIC POINT
 5 ---> VELOCITIES OF A SPECIFIC POINT
 6 ---> ACCELERATION OF A SPECIFIC POINT
 7 ---> MOORING LINE AND FENDER LOADS


4



 ---> SPECIFIC POINT NUMBER: BETWEEN 1 AND  1

1



 0 ---> NO FILE WRITING
 1 ---> CENTER OF GRAVITY MOTIONS
 2 ---> CENTER OF GRAVITY VELOCITIES
 3 ---> CENTER OF GRAVITY ACCELERATIONS
 4 ---> MOTIONS OF A SPECIFIC POINT
 5 ---> VELOCITIES OF A SPECIFIC POINT
 6 ---> ACCELERATION OF A SPECIFIC POINT
 7 ---> MOORING LINE AND FENDER LOADS


0



 0 ---> PROGRAM EXIT
 1 ---> WRITING OF RESULTS FILES
 2 ---> ADDITIONAL DURATION
 3 ---> ANALYSIS OF RESULTS


0
 ANOTHER RUN ? (YES:1 - NO:0)
0
```

CHOICE OF DIFFERENT OPTIONS (0 IS ALWAYS TO EXIT)