



Robert Gordon University



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Engineering and Physical Sciences
Research Council

Research to reduce the risk & uncertainty in marine energy development

An integrated modelling environment

Grégory Payne

Institute for Energy Systems

University of Edinburgh



WAMIT overview

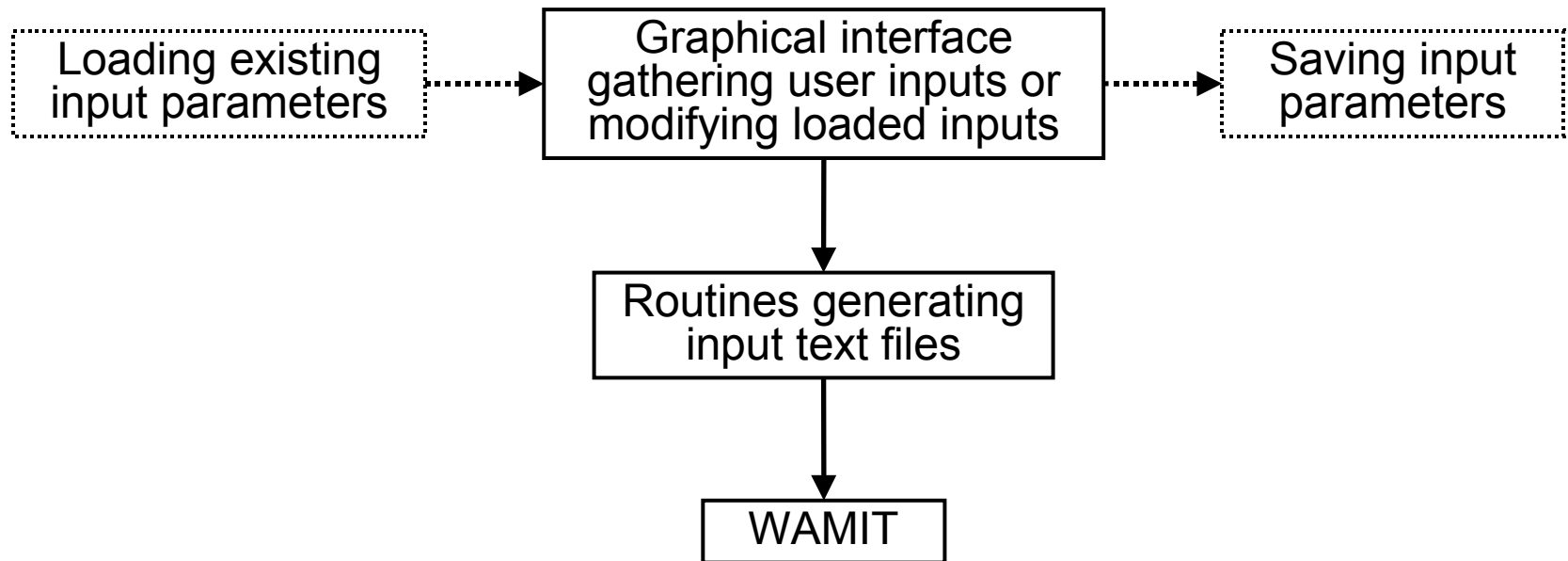
- State of the art computer program based on panel method for analysing wave body hydrodynamic interactions
- Efficient but not user friendly
- No graphical interface
- Input and output via text files

```
1.00000      9.80665  ULEN,GRAV
0  1  ISX,ISY
1  1      NPATCH, IGFORM
10  4      NUG,NVG  BLoftSurf loft_surf
4  4      KUG,KVG
-1. -1. -1. -1. -0.800000 -0.600000 -0.
-1. -1. -1. -1. -0.500000  0.000000  0.
0.00000  0.00000  0.00000
0.00750  0.00000 -0.00750
0.02140  0.00000 -0.02140
0.03890  0.00000 -0.03890
0.09140  0.00000 -0.09140
0.10090  0.00000 -0.10090
0.11260  0.00000 -0.09990
0.12030  0.00000 -0.09050
0.13460  0.00000 -0.06750
0.14540  0.00000 -0.03890
0.14900  0.00000 -0.02140
0.15030  0.00000 -0.00750
0.15000  0.00000  0.00000
0.00000  0.23000  0.00000
0.00750  0.23000 -0.00750
0.02140  0.23000 -0.02140
0.03890  0.23000 -0.03890
0.09140  0.23000 -0.09140
0.10090  0.23000 -0.10090
0.11260  0.23000 -0.09990
```

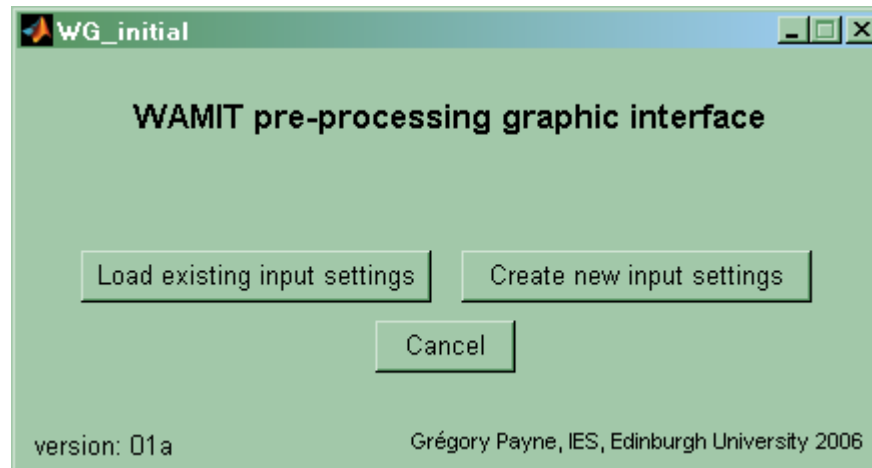
Integrated WAMIT modelling environment

- Pre-processing: graphical interface gathering user input and generating input text files
- Post-processing: graphical interface plotting WAMIT outputs
- Graphical interface programmed in MatLab

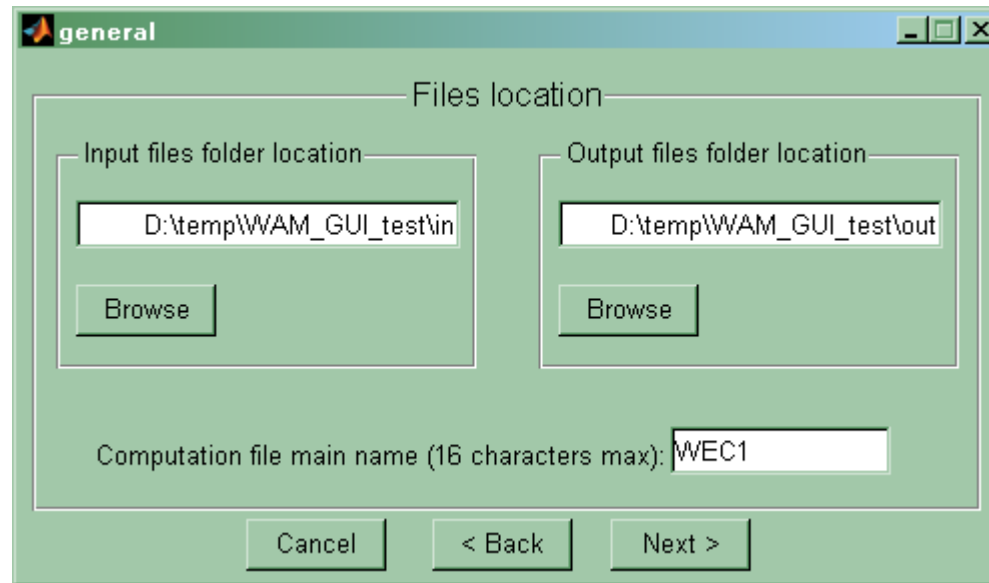
Pre-processing overview



Pre-processing



Pre-processing



Allow user to select the input and output files location

Pre-processing



config.wam settings

Configuration file (config.wam) settings

Irregular frequencies removal:

Force file alternative form:

Potential file alternative form:

Panel size settings

Specify panel size here Panel size:

Logarithmic singularity integration:

Unit of the period input:

POTEN subprogram

run Locate the relevant p2f file

Generalised modes

Use generalised modes

Number of generalised mode (NEWMDS):

Generalised mode index (IGENMDS):

Allow user to define the configuration file parameters

Pre-processing



pot1_GUI

Potential file (form 1) settings

Water depth in m (-1 for infinity): Body-fixed coordinate system position x
y
z
phi

Modes of motion to compute

Radiation problem Diffraction problem

Mode selection:

surge sway heave roll pitch yaw

Wave period selection

Periods range from to s

Number of periods to be analysed Periods to be analysed

1.6052632
1.6842105
1.7631579
1.8421053
1.9210526
2

Incident wave headings

Wave headings range from to degrees

Number of headings to be analysed Headings to be analysed

180

Allow user to define the potential file parameters

Pre-processing

A screenshot of a software window titled "frc2_GUI". The window has a light green background and a title bar with standard Windows window controls. The main content area is titled "Force file (alternative form 2)". Below the title, there is a section labeled "Output options" containing four checked checkboxes: "Added-mass and damping coefficients", "Exciting forces from Haskind relations", "Exciting forces from diffraction potential", and "Motion of body (RAO)". Below this section, there is a label "Dimensional water density:" followed by a text input field containing the value "1000". Further down, there are three rows of options, each with a checkbox and a corresponding button: "Mass properties" with a checked checkbox and an "Input mass properties" button; "External damping" with an unchecked checkbox and an "Input external damping" button; and "External stiffness" with an unchecked checkbox and an "Input external stiffness" button. At the bottom of the window, there are three buttons: "Cancel", "< Back", and "Next >".

Allow user to define the force file parameters

Pre-processing



mp_frc2

Mass properties for force file (alternative form 2)

Coordinates of the CoG: XCG = YCG = ZCG =

<input type="text" value="25.972"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="-11.116"/>	<input type="text" value="-0.059736"/>
<input type="text" value="0"/>	<input type="text" value="25.972"/>	<input type="text" value="0"/>	<input type="text" value="11.116"/>	<input type="text" value="0"/>	<input type="text" value="9.8252"/>
<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="25.972"/>	<input type="text" value="0.059736"/>	<input type="text" value="-9.8252"/>	<input type="text" value="0"/>
<input type="text" value="0"/>	<input type="text" value="11.116"/>	<input type="text" value="0.059736"/>	<input type="text" value="6.5604"/>	<input type="text" value="-0.0316"/>	<input type="text" value="5.6724"/>
<input type="text" value="-11.116"/>	<input type="text" value="0"/>	<input type="text" value="-9.8252"/>	<input type="text" value="-0.0316"/>	<input type="text" value="11.6563"/>	<input type="text" value="0.0349"/>
<input type="text" value="-0.059736"/>	<input type="text" value="9.8252"/>	<input type="text" value="0"/>	<input type="text" value="5.6724"/>	<input type="text" value="0.0349"/>	<input type="text" value="5.5062"/>

Allow user to define the mass matrix or to import it from SolidWorks

Pre-processing



geometry [minimize] [maximize] [close]

Geometry definition

Geometry definition method

Existing GDF file Analytical definition B-Spline definition from MultiSurf NBS file

B-Spline definition from NBS file

Run the NBS to GDF converter utility

Location of the created GDF file:

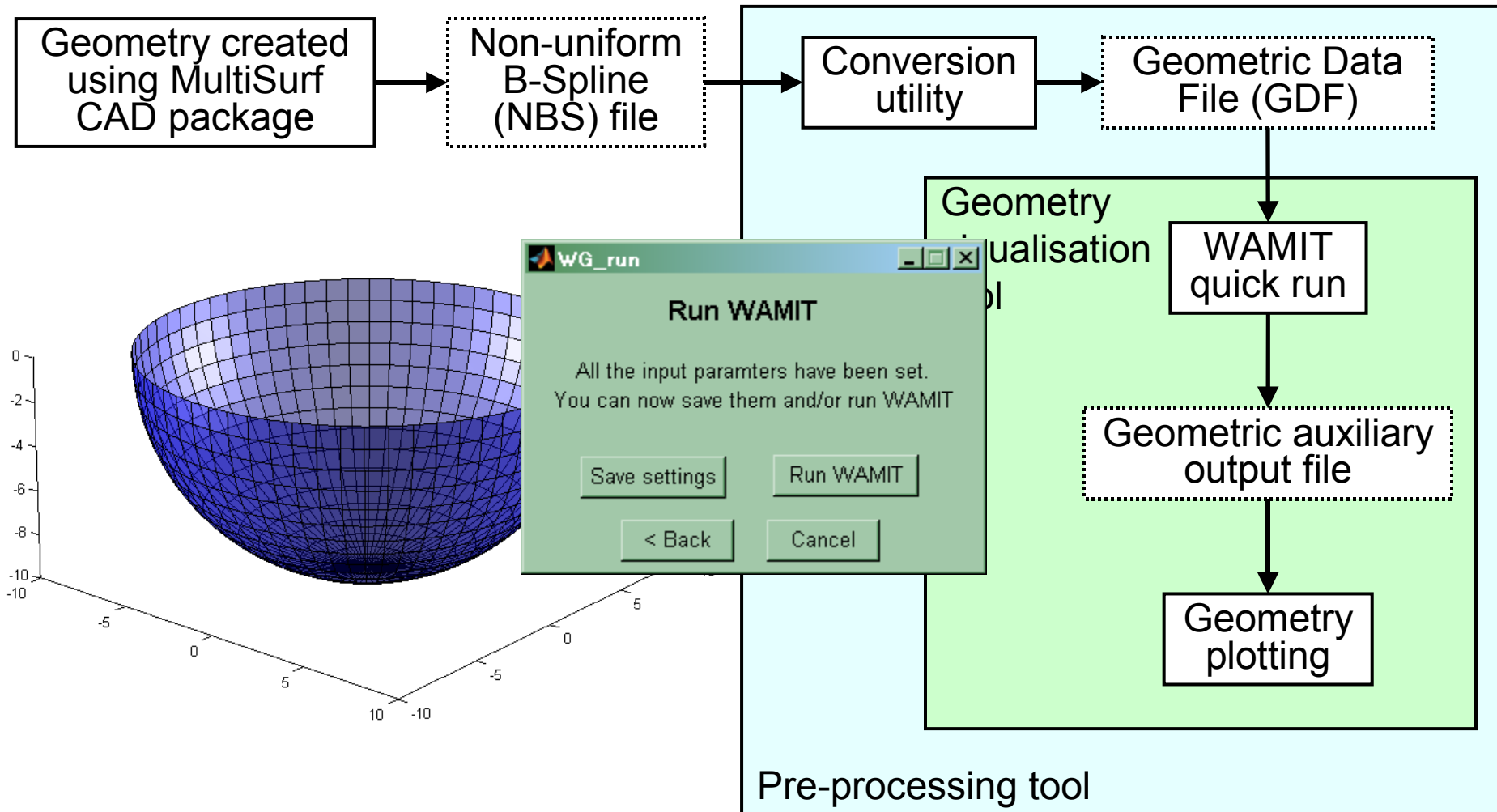
Geometry visualisation

Shift between body fixed and absolute coordinate systems: x = y = z = beta =

Typical dimensional panel size: ILOG: ▾

Allow user to define the input geometry

Pre-processing geometry input

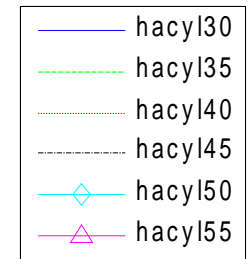
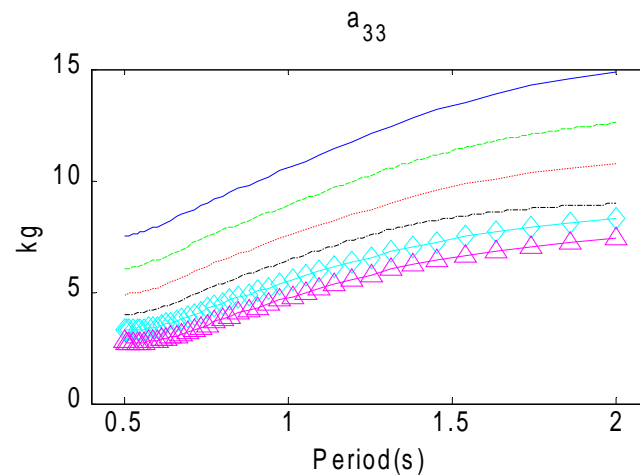
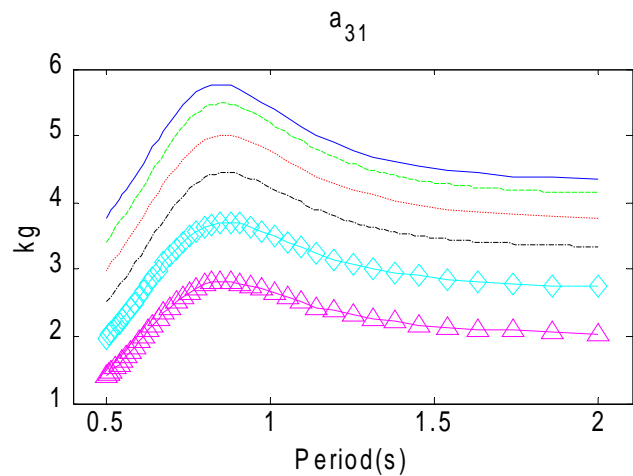
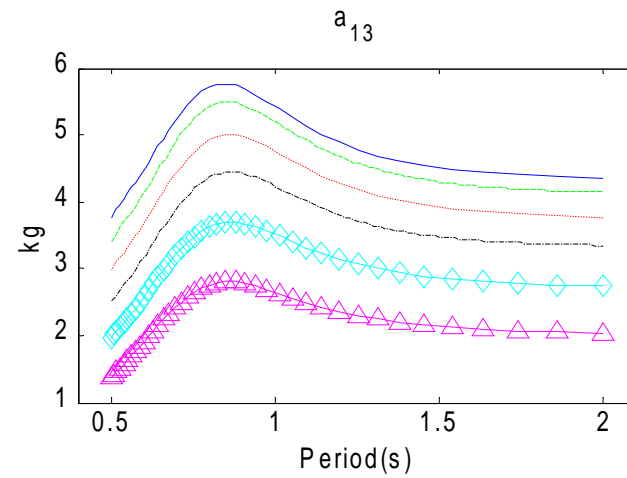
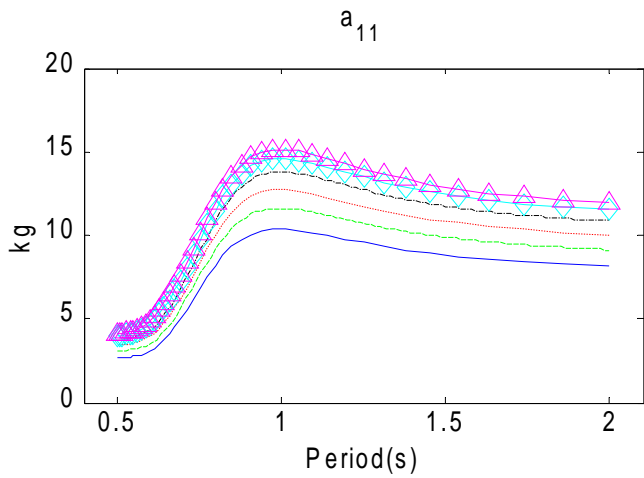


Post-processing

- Post-processing is by nature less generic than pre-processing
- Post-processing structured in independent modules
 - Added mass and radiation damping
 - Wave exciting force
 - Body response

Post-processing

added mass





Conclusions

- User friendly modelling environment integrating WAMIT, MultiSurf and SolidWorks
- Possibility of loading/saving input parameters making design improvements easy.

Conclusions

Input parameters

Without integrated modelling environment

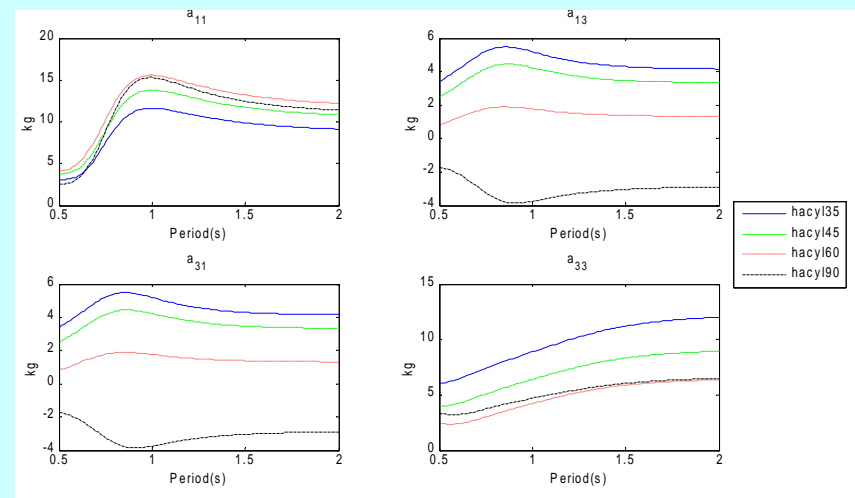
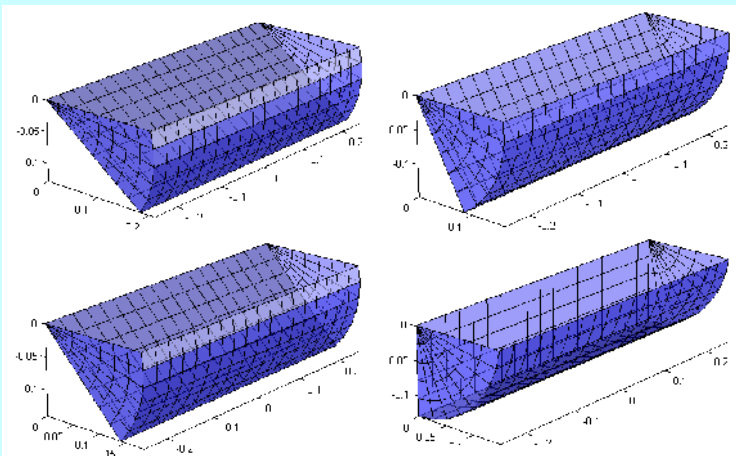
```

1.00000    9.80665    ULEN, GRAV
0 1    ISX, ISY
1 1    NPATCH, IGFORM
10 4    NUG, NVG    BLoftSurf    loft_surf    0 0 0 0
4 4    KUG, KVG
1. -1. -1. -1. -0.800000 -0.600000 -0.400000 -0.20000
1. -1. -1. -1. -0.500000 0.000000 0.500000 1. 1. 1.
0.00000 0.00000 0.00000
0.00750 0.00000 -0.00750
0.02140 0.00000 -0.02140
0.03890 0.00000 -0.03890
0.09140 0.00000 -0.09140
0.10090 0.00000 -0.10090
0.11260 0.00000 -0.09990
  
```

Computation outputs

0.500000E+00	1	1	3.730512E-03	4.133236E-03
0.500000E+00	1	3	2.511618E-03	1.524988E-03
0.500000E+00	3	1	2.509554E-03	1.522344E-03
0.500000E+00	3	3	3.989730E-03	1.815694E-03
0.515200E+00	1	1	3.777331E-03	4.397361E-03
0.515200E+00	1	3	2.597052E-03	1.584985E-03
0.515200E+00	3	1	2.594687E-03	1.582859E-03
0.515200E+00	3	3	3.998928E-03	1.934919E-03
0.530300E+00	1	1	3.816257E-03	4.687024E-03
0.530300E+00	1	3	2.688208E-03	1.636451E-03
0.530300E+00	3	1	2.685637E-03	1.634621E-03
0.530300E+00	3	3	4.016776E-03	2.056316E-03
0.545500E+00	1	1	3.866134E-03	5.013424E-03
0.545500E+00	1	3	2.784995E-03	1.680781E-03

With integrated modelling environment





Further work

- Structure of the modelling environment well suited for integrating future extensions