MANAGING RISK

DNV Software

Hydrodynamics Course
Introduction & Modelling

Revised: June 10, 2007

About the Course

MANAGING RISK

- I am Torgeir Vada, DNV Software
  - Head of Strength Assessment, DNV Software
- Responsibility for SESAM lies with DNV Software in Oslo, Norway, DNV's software house for technical applications
- The course covers:
  - Introduction to Hydrodynamics in Sesam/Nauticus
  - Hydrostatics and stability
  - Global dynamic analysis
  - Statistical post-processing
  - Animation
  - Transfer of wave loads to FEM analysis
- The course consists of lectures followed by workshops
- Hand-outs will contain copies of all material
- Before end of course, please fill in the enclosed course evaluation form

“Hydrodynamics” modules in Sesam

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General

- Wadam
  - General structures, zero speed, 3-dimensional
- Wasim
  - Ships, 3D theory, zero and non-zero speed

Special purpose

- Waveship
  - Ships, strip theory, zero and non-zero speed
- Wajac
  - Analysis of jackets
- Installjac
  - Launching of jackets

Postprocessing

- Postresp
  - Statistical postprocessing
- DeepC
  - Coupled analysis of floating systems
- Mimosa
  - Analysis of mooring systems

Hydrodynamics modules in Sesam Overview

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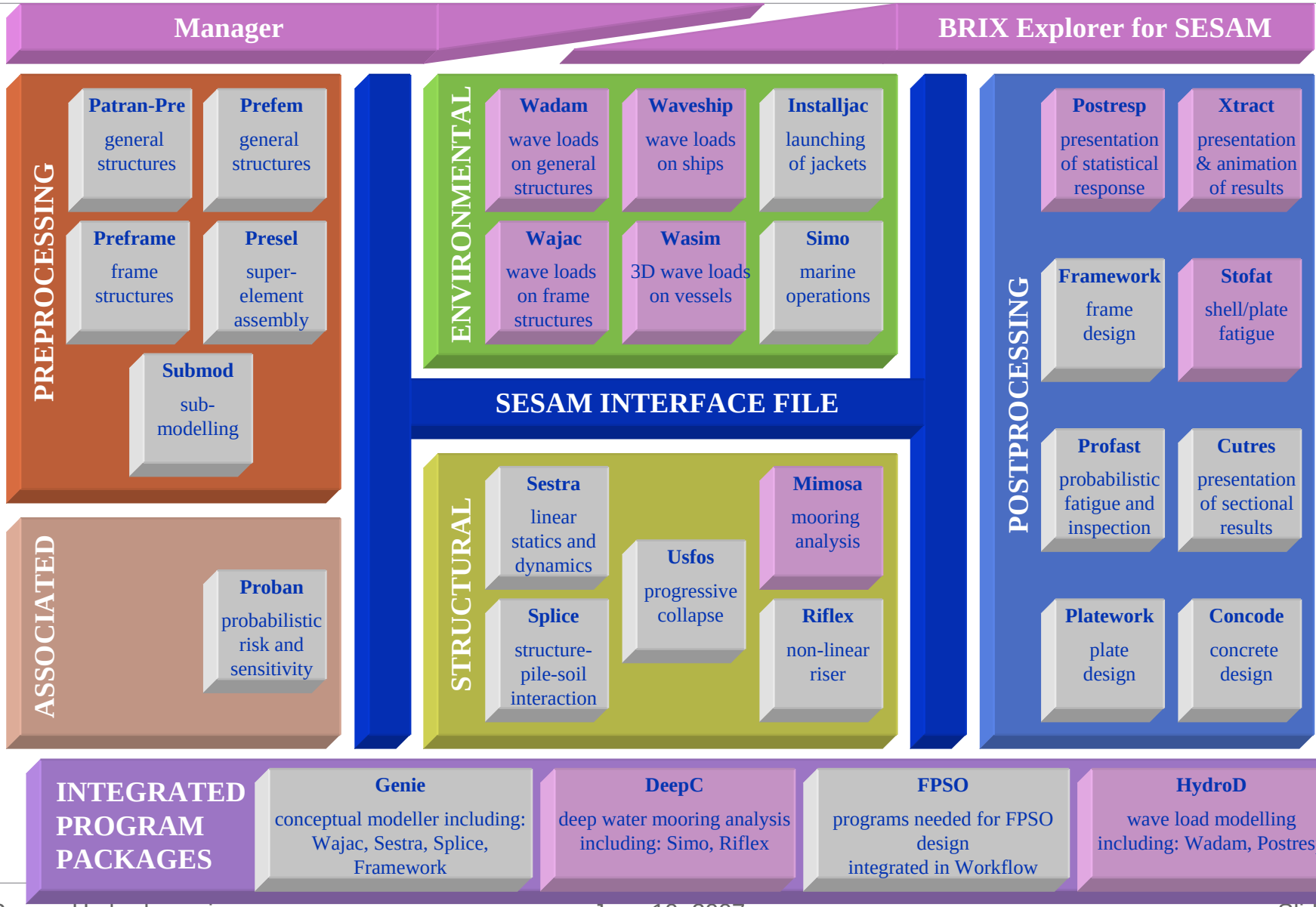

Comparison of hydrodynamics programs for large volume structures

	Wadam	Waveship	Wasim
Ships	☺	☺	☺
Offshore structures	☺	☹	😐
Morison model	☺	☹	☹
Forward speed	☹	😐	☺
Global response	☺	☺	☺
Local loads	☺	😐	☺
Non-linear option	☹	☹	☺
CPU consumption	😐	☺	☹

Wasim

- 3D radiation/diffraction theory
- “Arbitrary” geometry
- Zero to high forward Speed
- Infinite Water Depth
- Time domain with transfer to frequency domain
- Motions and Loads
- Pressures and wave elevation
- Motion control by autopilot
- Load Transfer to Sestra

Waveship

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- 2D Strip Theory
- Monohull
- Zero to moderate forward Speed
- Infinite Water Depth
- Added Mass, Damping Coefficients
- Motions and Loads
- Viscous Effects from Eddy Viscosity, Skin Friction, Bilge Keels
- ~~Load transfer to FEM solver Sestra~~
- Pressures around the hull not as accurate as Wadam and Wasim

Creating Wadam models

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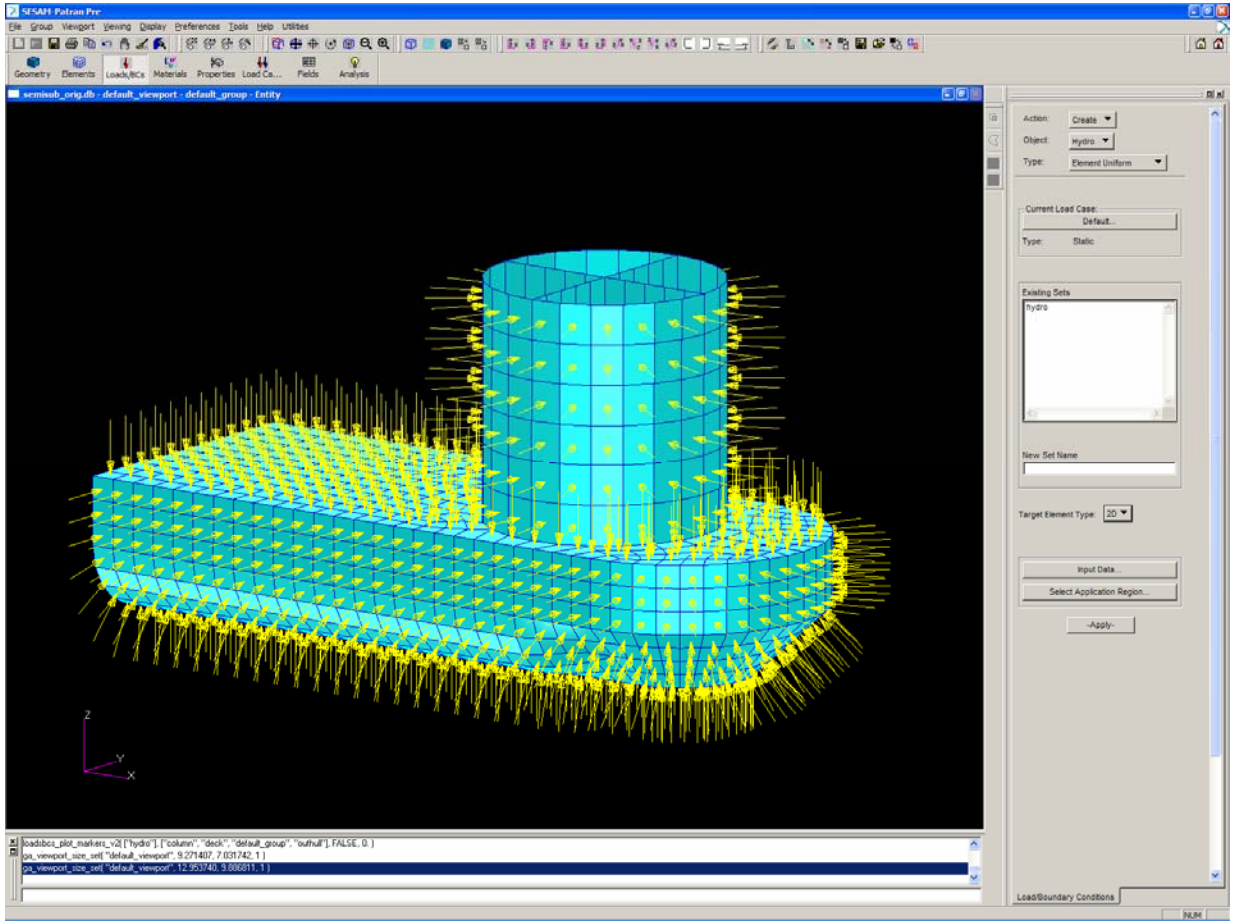
- Patran-Pre
- GeniE
  - NEW!
- (Prefem)



Acceptable elements for panel model

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- Shell elements:
  - Triangular flat thin shell (3)
  - Quadrilateral flat thin shell (4)
  - Subparametric curved triangular thick shell (6)
  - Subparametric curved quadrilateral thick shell (8)
  - Multilayer curved triangular shell (6)
  - Multilayer curved quadrilateral shell (8)
- Solid elements:
  - Triangular prism (6)
  - Linear hexahedron (8)
  - Tetrahedron (4)
  - Isoparametric triangular prism (15)
  - Isoparametric hexahedron (20)
  - Isoparametric tetrahedron (10)

Number of nodes in parentheses

Creating the panel model - wet surface

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- The external wet surface must be defined in load case 1
  - In GeniE, this is defined as a “Wet Surface” property assigned to the plates. The load case must be marked as “Dummy Hydro Pressure”
  - Patran-Pre: Loads/BCs menu: Create - Hydro - Element Uniform
- In GeniE and Patran-Pre the outside surface is controlled by the surface normal
  - GeniE: Select the “Front” or “Back” side of the plate
  - Patran-Pre: If wrong direction of load, reverse direction of surface or change input data from “Inward” to “Outward”
- Verify correctness by displaying mesh + load case 1
  - Or check in HydroD

Define wet surfaces in Patran-Pre

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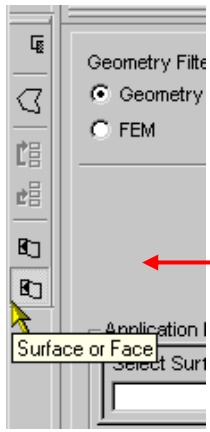
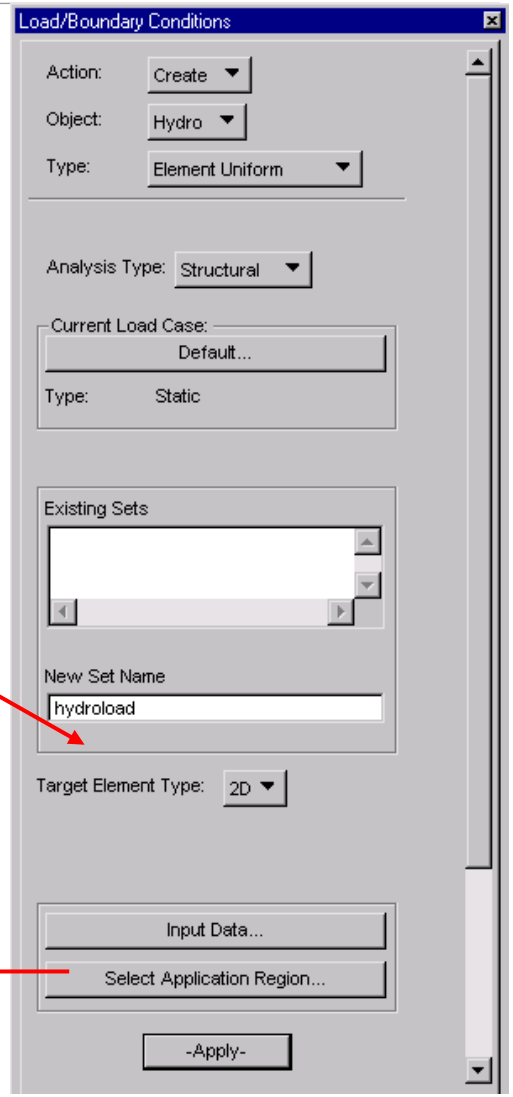
- Wet surfaces are defined in the Loads/BCs menu
- Select Create - Hydro - Element Uniform
- Define a new set name
- Define target element type
  - 2D - shell elements
  - 3D - solid elements
- Input data: Select ‘Inward’ or ‘Outward’
- Select application region
  - Choose “Surfaces or faces” in Select menu
- Needed for wave load analysis in Wadam for panel model and structural model





Verify direction in Patran-Pre

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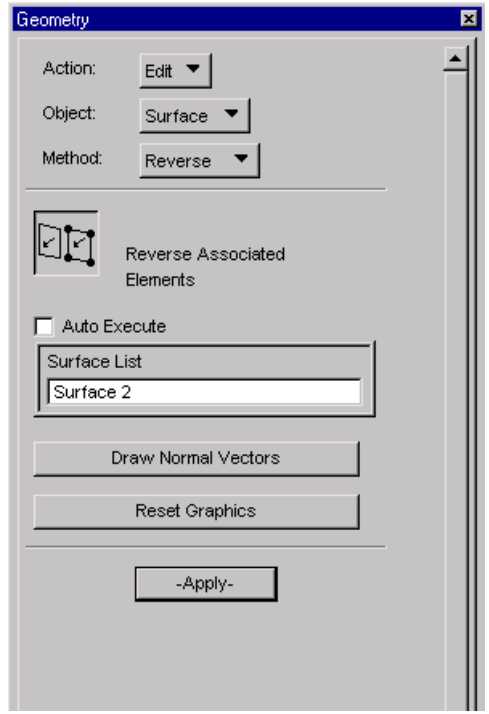
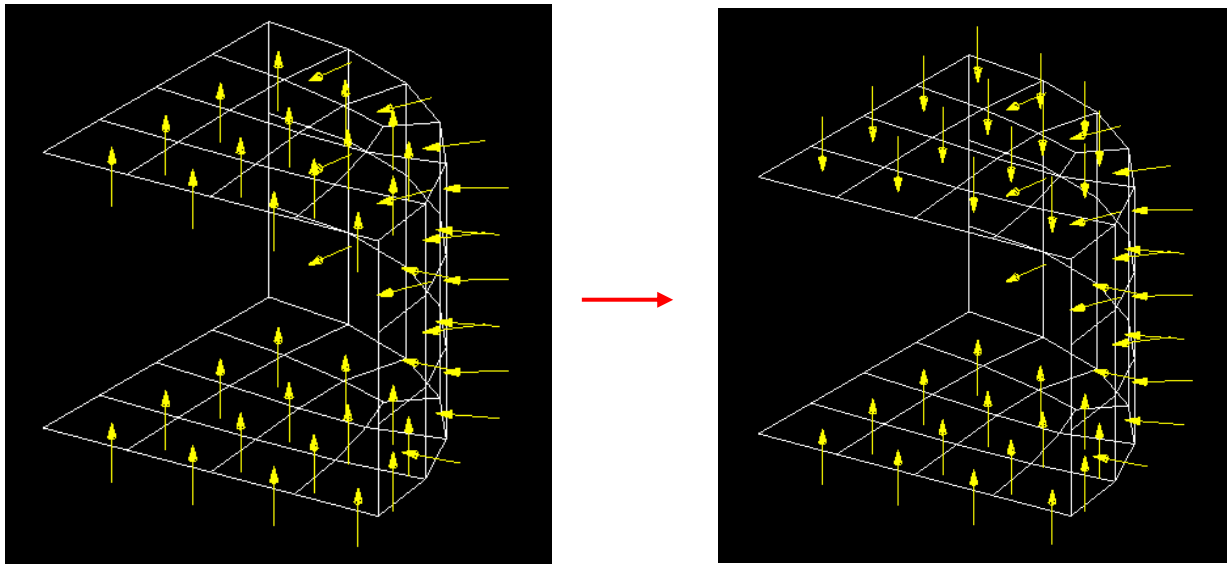
- The hydro load must be applied in the correct direction, arrows are plotted
- If wrong direction, change rotation of surface in the Geometry menu
  - Edit - Surface - Reverse
  - Select application region (top surface below)





Dynamic tank pressure

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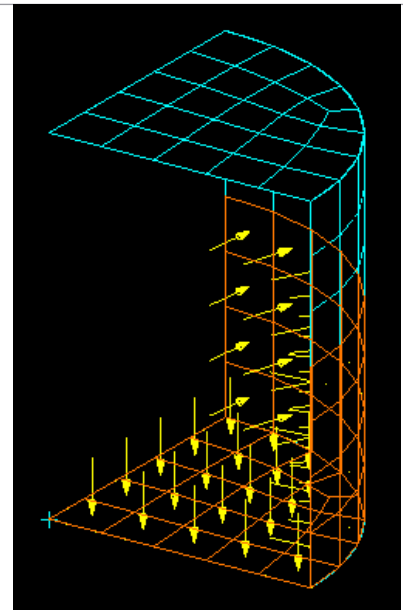
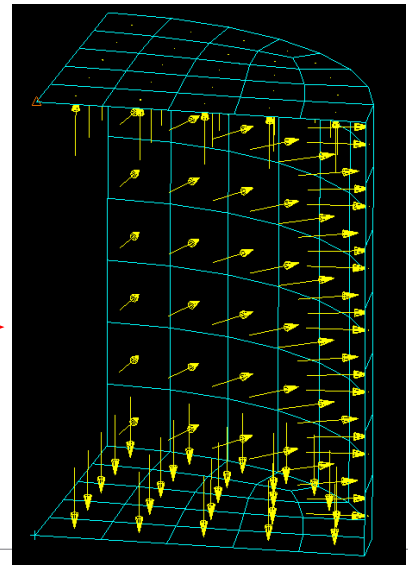
For the structural model:

- When using internal tanks in Wadam (pages 2-22, 2-48 in the user manual), define wet surface of inner walls of tank.
- The first tank must be defined in load case 2. The load case number is increased for each separate tank
- Before 2006: The hydro pressure must stop at the free surface of the tank

- From February 2006 (HydroD V2.0)
  - Assign wet surfaces to the entire tank
  - Give fraction of tank filling in HydroD





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