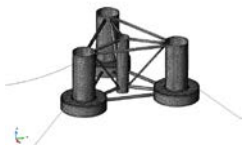


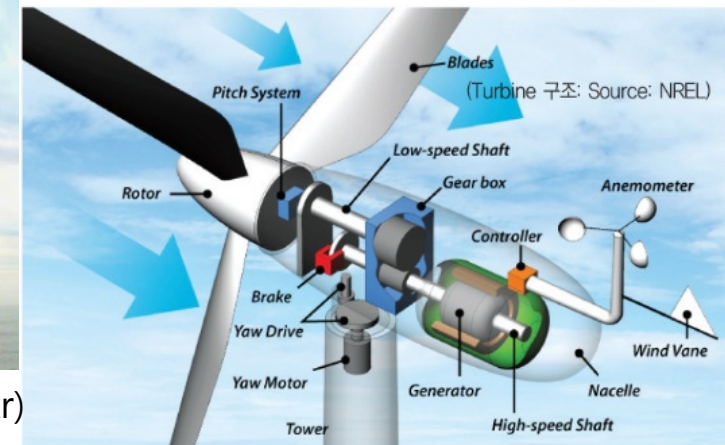
## Application: Offshore Wind Turbine Structural Engineering

# X-WIND

## Part 3: X-Nemoh (GUI for Analysis of Nemoh diffraction and radiation)



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tel) 82-2-452-8619 fax) 82-2-452-8619  
[www.xfinas.com](http://www.xfinas.com)



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Konkuk University, Seoul 143-701, Korea, tel) 82-2-2049-6074 fax) 82-2-452-8619

2022-12

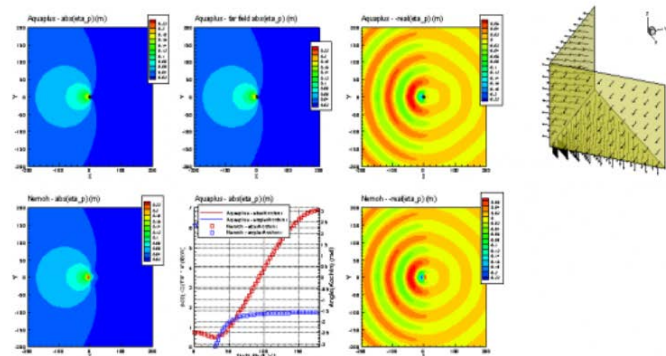
## Valorisation

PUBLICATIONS  
CHAIRES & PARTENARIATS  
INDUSTRIELS  
LOGICIELS ET BREVETS  
MÉDIATION SCIENTIFIQUE

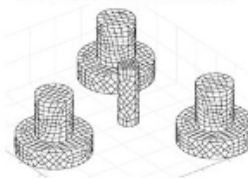


## NEMOH-Presentation

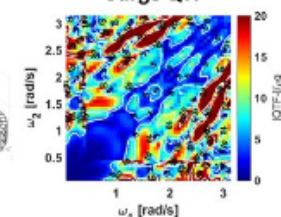
Discover all the information about NEMOH via the menu on the right



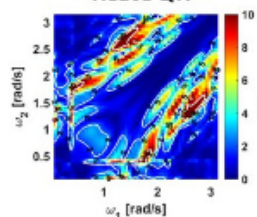
### OC4-Semisubmersible



### Surge QTF-



### Heave QTF-



### Pitch QTF-

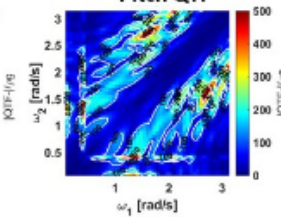


TABLE I: The Available BEM Solvers and

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101007142



BEM solver	Frequency domain	Time domain	Open source	Usage [%]*	Arrays*	Point Absorber*	OWC*	OWSC*	Other*	Time domain simulation*	Multiple modes*
WAMIT [2]	✓	✗	✗	80.5%	15.2%	39.3 %	24.2 %	21.2 %	21.2 %	44.5%	51.5 %
NEMOH [3]	✓	✗	✓	19.5%	12.5%	62.5 %	0 %	37.5 %	25 %	25 %	75%
AQWA [4]	✓	✗	✗	22%	11.1%	11.1 %	22.2%	11.1 %	44.4 %	55.5 %	77.7 %
Aquaplan [5]	✓	✗	✗	9.8%	25 %	25 %	0 %	50 %	50 %	100 %	50 %
ACHIL3D [6]	✗	✓	✗	4.9%	50 %	100 %	0 %	0 %	0 %	100 %	0%
WADAM [7]	✓	✗	✗	7.3%	66 %	33 %	33 %	0%	33%	100%	66%

\* Statistics are based on the publications in [1], where 14.2% of the publications referenced a BEM solver.

## Reference

Publication or report using NEMOH should refer to:

- A. Babarit, G. Delhommeau: Theoretical and numerical aspects of the open source BEM solver NEMOH. In Proc. of the 11th European Wave and T Energy Conference (EWTEC2015), Nantes, France

## Floating Platforms: NEMOH is included in X-OpenFAST

When modeling a floating system, you may use potential-flow theory only, strip-theory (Morison) only, or a hybrid model containing both. Potential-flow theory based on frequency-to-time-domain transforms is enabled through WAMIT or NEMOH.

The WAMIT or NEMOH model should account for all of the members in the floating substructure, and Morison's equation is neglected in this case.



[www.wamit.com](http://www.wamit.com): Commercial Software,

NEMOH

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[https://lheea.ec-nantes.fr > software-and-patents > nemo](https://lheea.ec-nantes.fr/software-and-patents/nemo): Open Source Software,  
1<sup>st</sup> order potential theory.

# X-Nemoh: Procedure of Analysis

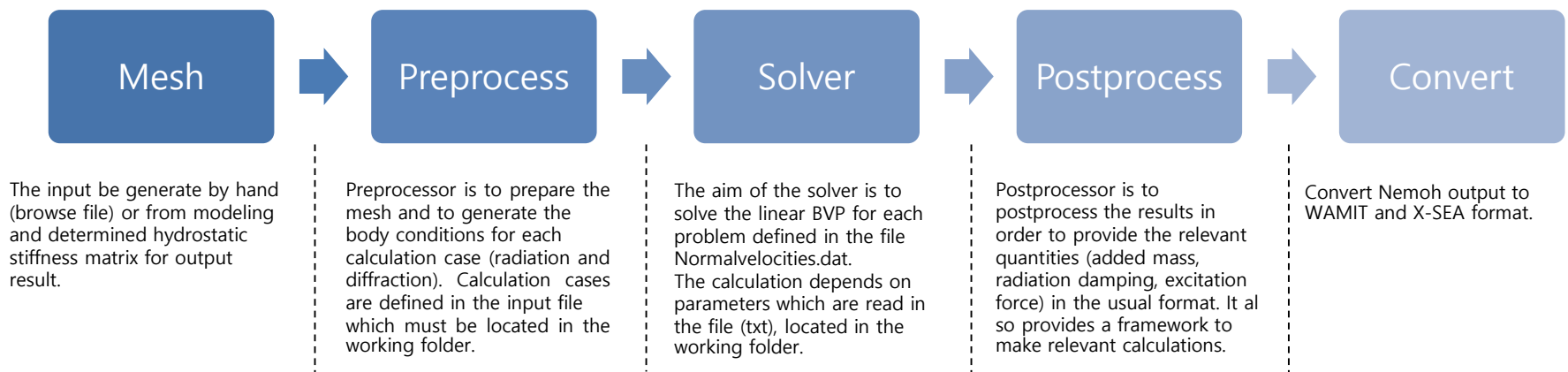
The open source code Nemoh is a numerical solver for computation of first order hydrodynamic coefficients such as added mass, radiation, damping and excitation forces in the frequency domain (Babarit and Delhommeau 2015).

The code has been developed for over 30 years at École Centrale de Nantes in France and was released in open source in January 2014. Nemoh is based on linear free surface potential flow theory with assumptions of an inviscid fluid and an incompressible and irrotational flow. Green's second identity and the appropriate Green function is applied. The resulting linear Boundary Value Problem (BVP) for the free surface flow around a body is of first order with assumptions of small motions around mean position and linearized free surface equations. In order to solve the linear BVP, Panel methods are applied in Nemoh.

Nemoh is composed of three different sets of programs for which are intended to run in sequent order listed as,

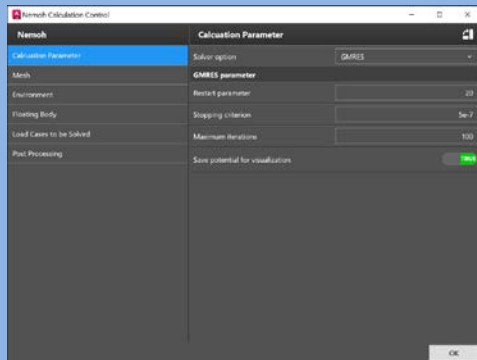
- *preProcessor*, reads and prepare the mesh and calculation cases with stated body conditions
- *solver*, solves the linear BVP with potential theory for stated body condition and calculates hydrodynamic coefficients
- *postProcessor*, processes the results and may be used for calculating RAOs and plot free surface wave elevation, external pressure.

A X-NEMOH provides with AutoCAD embedded GUI in order to define and process geometries and results in a more user-friendly environment.

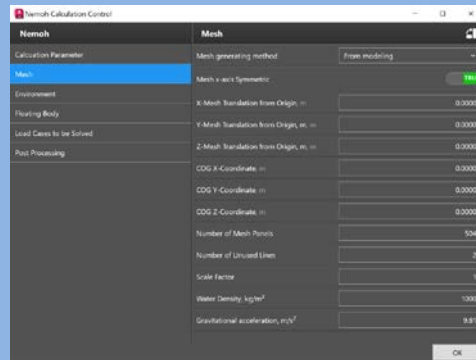


# X-Nemoh: GUI

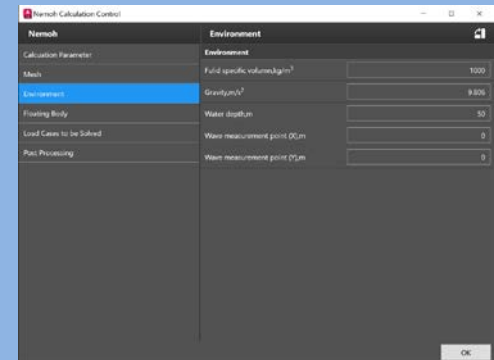
## Calculation parameter



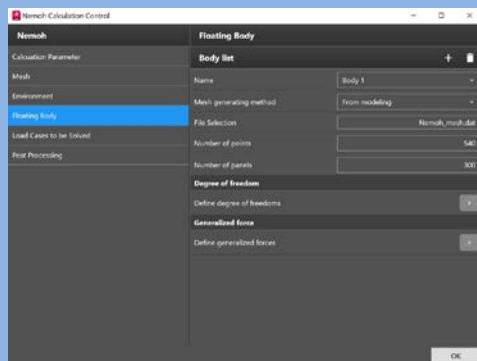
## Mesh



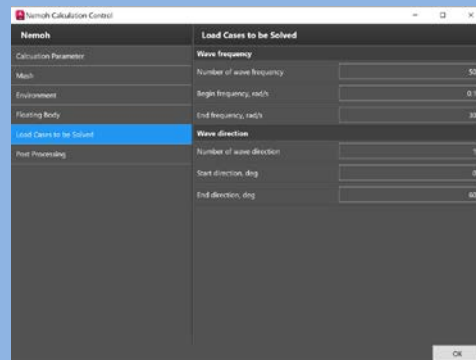
## Environment



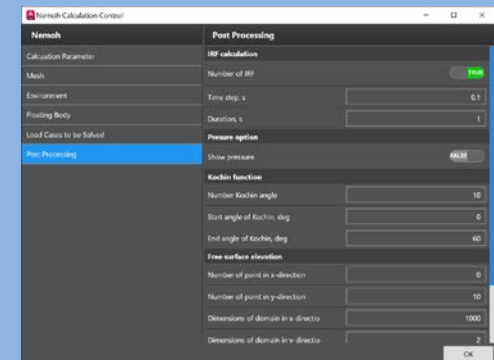
## Floating body



## Load case to be solved



## Post processing

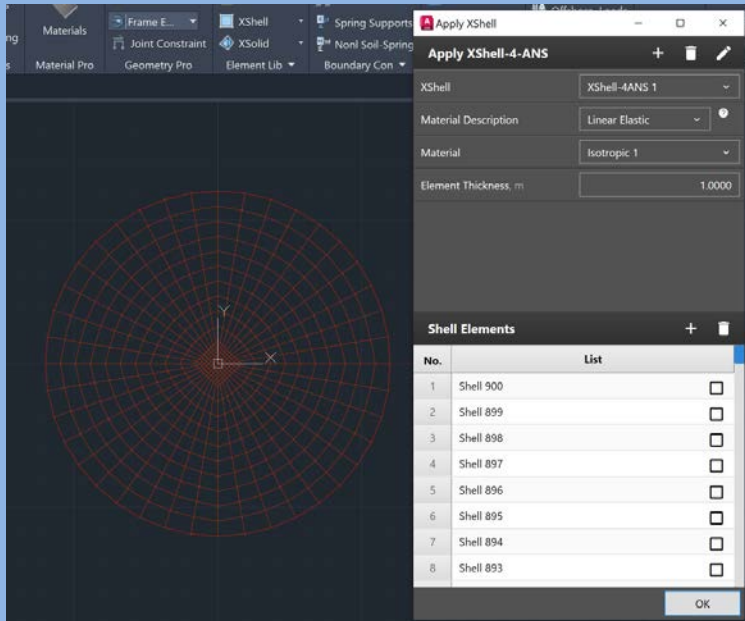


Category GUI of X-Nemoh are 6 difference types requiring input by user as calculation parameter, mesh, environment, floating body, load case to be solved and post processing



# X-Nemoh: Preprocess

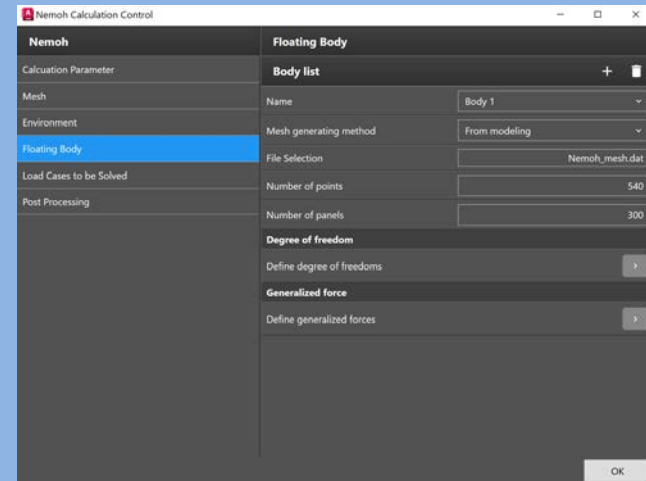
## X-SEA GUI: XShell 4-ANS



XShell element properties

Compatible point (node) and panel (mesh) between boundary element (BEM) and finite element method (FEM).

## X-Nemoh: GUI and File System



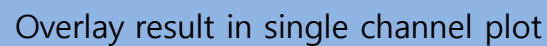
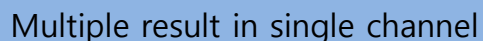
Floating body category

## Nemoh\_mesh.dat

X-Nemoh GUI is inserted number of panel and number of point into GUI automatically, and set as initialize data for simple analysis using.

Nemoh_mesh.dat				
		Z	0	
2	1	-1.146937046e-13		-30
2	2	-0.445399131	2.963065	-30
3	3	-0.420089272	2.65939088	-30
4	4	-1.03921362e-15	2.24	-30
5	5	-0.375711173	2.40466607	-30
6	6	-0.108565e-14	2.48	-30
7	7	-0.383719871	2.34658464	-30
8	8	-0.0399438e-15	2.22	-30
9	9	-0.291336321	1.9032849	-30
10	10	-6.09142351e-16	1.96	-30
11	11	-0.249224913	1.6354785	-30
12	12	-5.742053e-16	1.7	-30
13	13	-0.20734261	1.3022436	-30
14	14	-4.5942235e-16	1.44	-30
15	15	-0.165448073	1.125013	-30
16	16	-3.44571177e-16	1.10	-30
17	17	-0.22393034	0.6698132	-30
18	18	-2.2591411e-16	0.92	-30
19	19	-0.0814447	0.6147271	-30
20	20	-1.1435055e-16	0.46	-30
21	21	-0.04	0.36	-30
22	22	-0.0	0.4	-30
23	23	-0.9070508	2.85316960	-30
24	24	-0.02907316	2.55066361	-30
25	25	-0.7432565	2.295733	-30
26	26	-0.67270546	2.04855042	-30
27	27	-1.54354	1.74657347	-30
28	28	-0.451846651	1.5500788	-30
29	29	-0.409305473	1.30402875	-30
30	30	-0.326623184	1.05973276	-30
31	31	-0.24451378	0.8114388	-30
32	32	-0.1621535	0.56585944	-30
33	33	-0.08	0.30	-30
34	34	-1.36197138	2.67301965	-30
35	35	-1.21745425	2.392075	-30
36	36	-1.0848498	2.14375487	-30
37	37	-0.9451938	1.90387888	-30
38	38	-0.843781	1.67028344	-30
39	39	-0.7223067	1.43796	-30
40	40	-0.602211638	1.20601156	-30

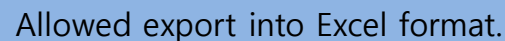
# Graph plotter



## Table and export file

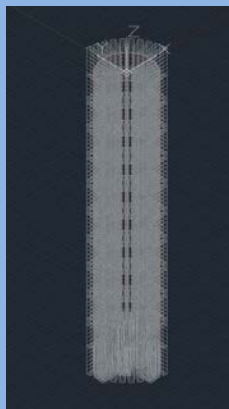


View result of Nemoh in table form.



# X-SEA, X-Nemoh and X-OpenFAST

X-SEA



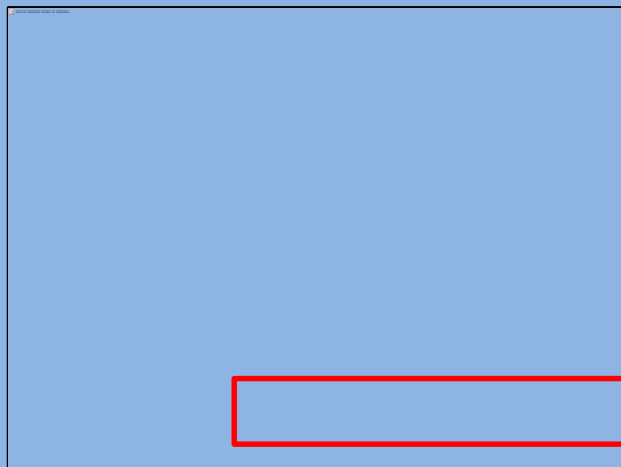
Panel pressure force acting on finite element model (FEM) in time domain analysis (On progress)

OpenFAST

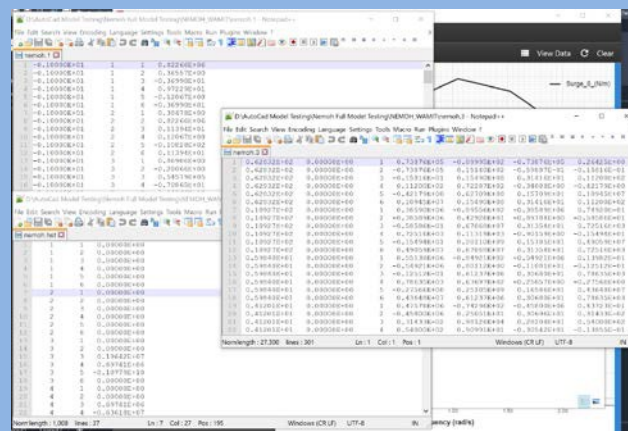
To analysis potential-flow for floating wind turbine offshore in OpenFAST is required output from WAMIT program. Its are in n a standard nondimensional form that HydroDyn will dimensionalize internally upon input.

The .hst file contains the 6x6 linear hydrostatic restoring (stiffness) matrix of the platform. The .1 file contains the 6x6 frequency-dependent hydrodynamic added-mass and damping matrix of the platform from the radiation problem. The .3 file contains the 6x1 frequency- and direction-dependent first-order wave-excitation force vector of the platform from the linear diffraction problem.

X-Nemoh



Allowed convert to WAMIT and XSEA



WAMIT and X-SEA file system