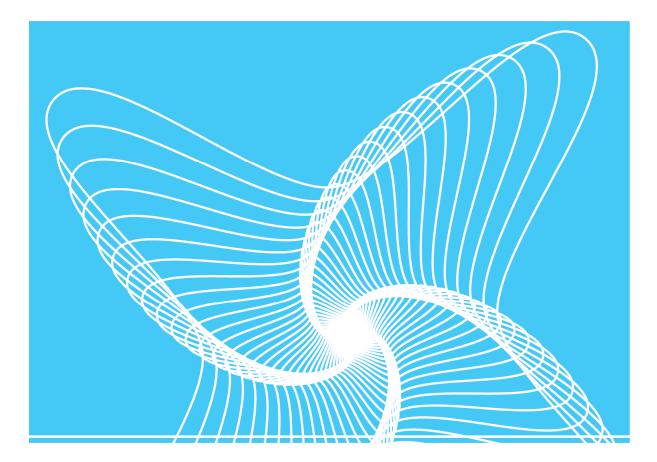


SESAM TUTORIAL



Stability and Hydrostatic Analysis of SemiSubmersible

Valid from program version 5.0-05, build 5196



Sesam Tutorial

HydroD - Stability and Hydrostatic Analysis of Semisubmersible

Date: 29 January 2016, Revision 03

Valid from HydroD version 5.0-05 build 5196

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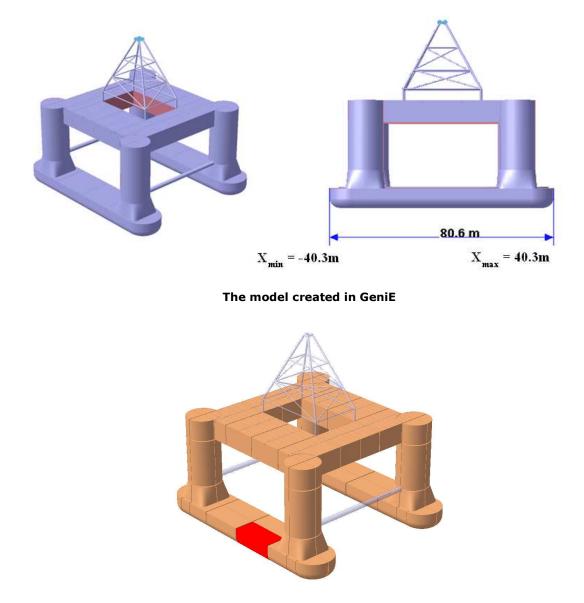
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1 INTRODUCTION

The text in this tutorial describes the necessary steps to do stability and hydrostatic analysis of a semisubmersible as well as checking the compliance to NMA stability rule.

The semi-submersible has 22 compartments which can be filled independently – in this tutorial you are asked to do various tank fillings to see the effect on stability parameters like e.g. equilibrium position and the computed GZ-curves.

The panel model, compartment model (used to describe the tanks) and the mass model have been created in GeniE. The total mass of the structure (mass model) is 21258989.9 kg. The file describing the panel model is called Panel_T543.FEM (notice that this file uses a Panel_T1.FEM file), the compartment model and the mass model is named Structure_T4.FEM.



The compartment model and mass model defined in GeniE

In addition to the text input, there is also a journal file Semi_submersible_Stability.js that you can read into HydroD to rapidly reproduce the workshop. Please make sure that the journal file and the FEM files are in the same folder.

This tutorial should be viewed on-line or on colour print out to best see the property colour coding.

2 START HYDROD AND MAKE A NEW WORKSPACE

You start HydroD from

• Desktop



Start All Programs |DNV GL - Software\Applications |HydroD

للله DNV GL - Software لله Applications

You make a new workspace from Ribbon button bar

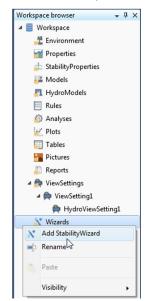
¥ 💾	50		
File	Hom	ne Help	
1 N	ew	Recent Workspaces	
🧀 o	pen	New (Ctrl+N)	
💾 Sa	ave	Create a new workspace	
🔚 Б	port as	tem	

- For this workspace, we use input units Metric (m, kg)
- In this tutorial we have used the default Workspace directory which is C:\DNVGL\Workspaces\HydroD. You may of course use other directories.

New workspace		. 🗆 🗙
Workspace name 💡	Semi_submersible_Stability	
Location 💡	C:\DNVGL\Workspaces\HydroD	Browse
Full path 💡	C:\DNVGL\Workspaces\HydroD\Semi_submersible_Stal	
Template 💡	Default*	Set default
Input units 💡	Metric (m, kg)*	Set default
🔲 Command input file 💡		Browse
	ОК	Cancel

3 STABILITY WIZARD

Add a *StabilityWizard* to the *Wizards* folder in the *Workspace browser*.



Go to the Properties window of StabilityWizard1 and set the properties as below

Properties	* ₫ ×
💦 StabilityWizard1	
Concept steps	
Morison model	💡 🗖
Compartments	😵 💌
Damage case	😵 💌
Openings	💡 🔽
Heeling force model	💡 🔽
Wind heeling moments	💡 🔘 Projected area wind heeling moments
	Shape coefficient wind heeling moments
	Over the second seco
Thruster	💡 📖
Bilge	💡 🔲
Analysis steps	
Stability rule check	💡 🔽
MaximumKG analysis	💡 🔽
Strength analysis	9 V
Settings	
Properties	

Then execute *StabilityWizard1*. A wizard dialog will pop up to guild you to set up the stability analyses step by step.

🔺 🟋 Wizards							
X StabilityWizard1							
	* Execute						
	Rename						

Step 1 – Create Location

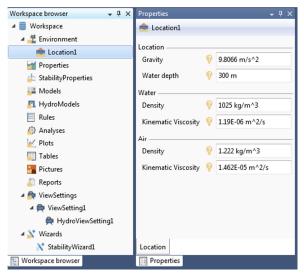


In the wizard dialog, there are three buttons on the top:

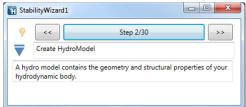
- Step backward
- Step
- Step forward

You could use the *Step backward* and *Step forward* to navigate to a backward or forward step for changes. When you click the *Step* button in the middle, corresponding concept will be created (the first time you click it) and selected in the *Workspace browser* and its properties will show in the *Properties* window.

In this step, a *Location* is created and you could change its properties of the *Loaction* in the *Properties* window. In this tutorial, we keep the default values.

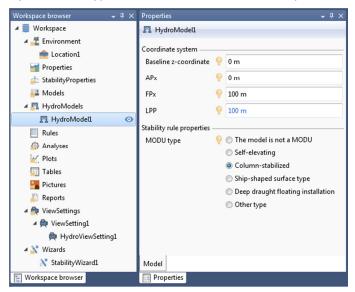


Step 2 – Create HydroModel

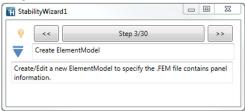


In this step, a *HydroModel* will be created, which contains the geometry and structural properties of the semi-submersible.

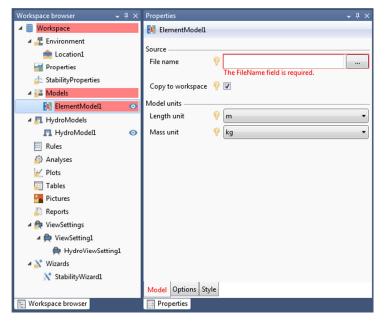
In the tutorial, we specify the *MODU type* as *Column-stabilized* in the *Properties* window.



Step 3 - Create ElementModel



In this step, an *ElementModel* will be created, which will be referred by the PanelModel in next step.

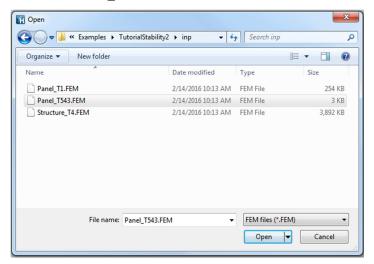


The created *ElementModel* is marked as red in the *Workspace browser*. This is because the *file name* is not specified yet. Such error information could also be found in the *Status* window.

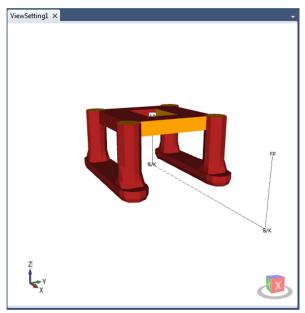
Locate the file Panel_T543.FEM stored under C:\Program Files\DNVGL\HydroD V5.0-

05\Doc\Examples\TutorialStability2\inp. The path name assumes you have installed the program HydroD using default values when installing.

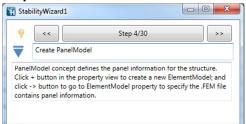
Remember that this file refers to Panel_T1.FEM.



After this step, the *ElementModel* is shown in the 3D window.



Step 4 - Create PanelModel



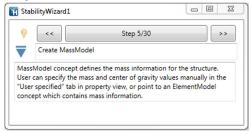
In this step, a *PanelModel* will be created, which specifies the outer wetted surface to calculate the floater buoyancy.

The created PanelModel is referred to ElementModel1 created in previous step.

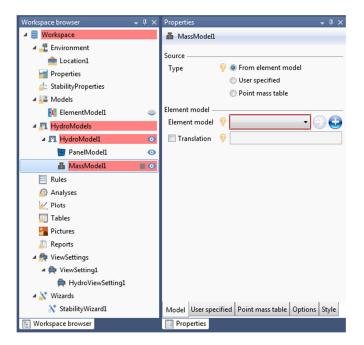
There are no symmetry planes in this model and a translation of 7.5 m in z direction is applied.

Workspace browser	• 4 ×	Properties	→ ‡	×
🔺 🧮 Workspace		📅 PanelModel1		
🔺 🚢 Environment				
💼 Location1		Source		
Properties		Element model 🛛 🧍	? 🚺 ElementModel1 🔹 🗸 😜	9
📥 StabilityProperties		Symmetry in XZ 📢	2	
4 🕌 Models		Symmetry in YZ 📢	2	
🚺 ElementModel1	•	Translation	0 m, 0 m, 7.5 m	
🔺 🛐 HydroModels			011,011,7511	-1
🔺 🋐 HydroModel1	Ο			
📅 PanelModel1	Ο			
📃 Rules				
Analyses				
📈 Plots				
Tables				
Pictures				
Reports				
🔺 🚔 ViewSettings				
🔺 🚔 ViewSetting1				
🚔 HydroViewSettin	g1			
🛯 🏹 Wizards				
💦 StabilityWizard1		Model Style		
🔚 Workspace browser		Properties		

Step 5 – Create MassModel



MassModel may be from an *element model*, specified by user or defined by point mass table. In this tutorial, the mass model is from an element model.



Click the "+" button to add an *ElementModel* to the *Models* folder in the *Workspace browser*.

Treate concept		x
Create a 💡		
ElementModel		•
under the following parent concept $$		
4 🛢 Workspace		
- Models		
ОК	Cance	
UK	Cance	21

Then click the "->" button to navigate to the *Properties* window of *ElementModel*.

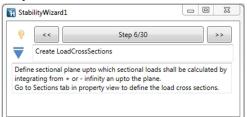
Workspace browser 🗸	ųΧ	Properties 🗸 🕂 🗙
4 📑 Workspace	^	🔁 ElementModel2
🔺 🚢 Environment		
💼 Location1		Source
Properties		File name 💡 The FileName field is required.
📥 StabilityProperties		Copy to workspace 💡 🔽
A 📲 Models		
🚺 ElementModel1	•	Model units
ElementModel2	0	Length unit 💡 m 🔹
▲ I HydroModels		Mass unit 💡 kg 🔹
▲ I HydroModel1	0	
🔡 PanelModel1	0 E	
👗 MassModel1 📃	0	
📃 Rules		
🎒 Analyses		
📈 Plots		
🛄 Tables		
Pictures		
🖺 Reports		
🔺 🚔 ViewSettings		
🔺 🚔 ViewSetting1		
🚔 HydroViewSetting1		
🔺 💦 Wizards	-	Model Options Style
📔 Workspace browser		Properties

Locate the file Structure_T4.FEM stored under C:\Program Files\DNVGL\HydroD V5.0-05\Doc\Examples\TutorialStability2\inp. The path name assumes you have installed the program HydroD using default values when installing.

Set a translation of 7.5 m in z direction in the properties view of the *MassModel*.

Workspace browser	т ф	×	Properties 👻 🕂 🗙
🔺 藚 Workspace		*	👗 MassModel1
🔺 🚢 Environment			
💼 Location1			Source
M Properties			Type 🤗 💿 From element model
📥 StabilityProperties			O User specified
🔺 🕌 Models			Point mass table
🚺 ElementModel1			Element model
🚺 ElementModel2	Ο		Element model 💡 🚺 ElementModel2 🛛 🚽 😜 🛟
🔺 🛐 HydroModels			Translation 💡 0 m, 0 m, 7.5 m
🔺 🌉 HydroModel1	Ο		
🔡 PanelModel1	Ο	Ξ	
👗 MassModel1	••		
📃 Rules			
🎒 Analyses			
📈 Plots			
🔲 Tables			
Pictures			
📳 Reports			
🔺 🚔 ViewSettings			
🔺 🚔 ViewSetting1			
🚔 HydroViewSetting1			
🔺 💦 Wizards		Ŧ	Model User specified Point mass table Options Style
🔄 Workspace browser			Properties





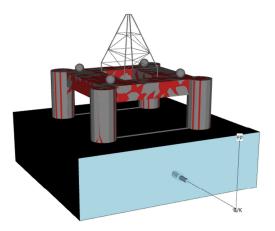
To compute still water forces and moments, you need to specify at which cross sections the program shall compute these.

In the *Model* tab of *Properties* window, specify *Type* as *YZ* and *Integration side* as *Positive*.

In the Sections tab of Properties window, set the section positions as below.

Workspace browser	→ ↓ ×	Properties		≁ ü ×
🔺 🧮 Workspace		🖶 LoadCross	Sections1	
🖻 ቿ Environment		o ::		
Marco Properties		Orientation —	💡 💿 YZ	
📥 StabilityProperties		Туре		
🛛 🕌 Models			© XZ © XY	
🔺 🛐 HydroModels			-	
🔺 🖳 HydroModel1	•	Integration sid	le 💡 💿 Positive	
🔡 PanelModel1	o		Negative	e
👗 MassModel1	• •			
🛁 LoadCrossSections	1 🔹 🔿			
📃 Rules				
🎒 Analyses				
📈 Plots				
🔟 Tables				
Pictures				
Reports				
🛚 🚔 ViewSettings				
🔺 💥 Wizards				
💦 StabilityWizard1		Model Sectio	ns Style	
🗄 Workspace browser		Properties		
Workspace browser	- ₽ ×	Properties		≁ ù ×
🔺 🧮 Workspace	- ‡ ×	Properties	Sections1	→ ╄ ×
✓ Uorkspace ▶ ▲ Environment	- ↓ ×	🖶 LoadCross		* 1 ×
 Workspace Environment Properties 	- ↓ ×	LoadCross	t	≁ ù ×
 Workspace Environment Properties StabilityProperties 	• ₽ ×	LoadCross Reference point X 9	t 0 m	- ů ×
 Workspace Environment Properties 	≁ ₫ X	LoadCross	t	• # ×
 Workspace Environment Properties StabilityProperties 	• 1 ×	LoadCross Reference point X 9	t 0 m	- # ×
 Workspace Workspace Torperties StabilityProperties Models 	• # ×	LoadCross Reference point X Q Y Q Z Q	t 0 m 0 m	- # ×
 Workspace Environment Properties StabilityProperties StabilityProperties Models Ndroma 		LoadCross Reference point X Q Y Q	t 0 m 0 m	→ ♯ ×
 Workspace Environment Properties StabilityProperties StabilityProperties Models HydroModels HydroModel1 	0	LoadCross Reference point X 99 Y 99 Z 99 Section position	t 0 m 0 m	
 Workspace Environment Properties StabilityProperties StabilityProperties HydroModels M HydroModel1 PanelModel1 	• •	LoadCross Reference point X @ Y @ Z @ Section position	t 0 m 0 m To	Step
 Workspace Environment Properties StabilityProperties StabilityProperties HydroModels M HydroModel1 PanelModel1 MassModel1 	• •	LoadCross Reference point X Q Y Q Z Q Section position From 1 -50 m	t 0 m 0 m To	Step
 Workspace Environment Properties StabilityProperties StabilityProperties HydroModels HydroModel1 HydroModel1 MassModel1 LoadCrossSections 	• •	LoadCross Reference point X Q Y Q Z Q Section position From 1 -50 m	t 0 m 0 m To	Step
Workspace Workspace Main StabilityProperties StabilityProperties StabilityProperties Models Mit Models Mit MydroModel1 MassModel1 MassModel1 LoadCrossSections Rules	• •	LoadCross Reference point X Q Y Q Z Q Section position From 1 -50 m	t 0 m 0 m To	Step
Workspace Workspace Main Second	• •	LoadCross Reference point X Q Y Q Z Q Section position From 1 -50 m	t 0 m 0 m To	Step
Workspace Workspace Main Second	• •	LoadCross Reference point X Q Y Q Z Q Section position From 1 -50 m	t 0 m 0 m To	Step
 Workspace Environment Properties StabilityProperties StabilityProperties HydroModels HydroModel1 PanelModel1 MassModel1 CoadCrossSections Rules Analyses Plots Tables 	• •	LoadCross Reference point X Q Y Q Z Q Section position From 1 -50 m	t 0 m 0 m To	Step
 Workspace Environment Properties StabilityProperties StabilityProperties HydroModels HydroModel1 PanelModel1 MassModel1 CoadCrossSections Rules Analyses Plots Tables Pictures 	• •	LoadCross Reference point X Q Y Q Z Q Section position From 1 -50 m	t 0 m 0 m To	Step
 Workspace Morkspace Frvironment Properties StabilityProperties StabilityProperties HydroModels HydroModel1 PanelModel1 MassModel1 LoadCrossSections Rules Analyses Plots Tables Pictures Reports 	• •	LoadCross Reference point X Q Y Q Z Q Section position From 1 -50 m	t 0 m 0 m To	Step
 Workspace Workspace Frienders StabilityProperties StabilityProperties StabilityProperties HydroModels HydroModel1 PanelModel1 MassModel1 CoadCrossSections Rules Analyses Plots Tables Pictures Reports Reports WewSettings 	• •	LoadCross Reference point X Q Y Q Z Q Section position From 1 -50 m	0 m 0 m 0 m To 50 m	Step

The cross sections are shown in the 3D window.



Step 7 – Create StructureReduction

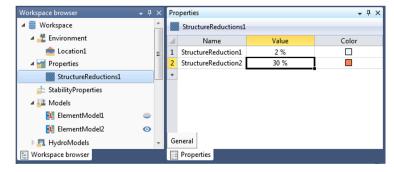


StructureReduction describes the fraction of the compartment volume that is occupied by structure or devices. The fraction of the compartment volume that can be filled with fluid in intact condition equals to 100% minus value of *StructureReduction*.

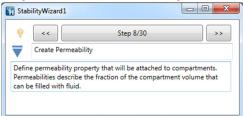
In this tutorial, define the *StructureReductions* as below.

Name	Value
StructureReduction1	2%
StructureReduction2	30%

By clicking the *Step* button, *StructureReductions1* and *StructureReduction1* will be created automatically. And *StructureReduction2* can be created by clicking the "+" button in the *properties* window of *StructureReductions1*.







Permeability describes the fraction of the compartment volume that can be filled with sea water in damaged condition.

In this tutorial, define the *Permeabilities* as below.

Name	Value
Permeability1	95%
Permeability2	65%

By clicking the *Step* button, *Permeabilities1* and *Permeability1* will be created automatically. And *Permeability2* can be created by clicking the "+" button in the *properties* window of *Permeabilities1*.

Workspace browser 🗸 🗸	ł×	Properties		- ₽ ×
🔺 🗮 Workspace	~	Permeabilities1		
4 🚢 Environment	Ξ	▲ Name	Value	Color
💼 Location1		1 Permeability1	95 %	
🔺 📹 Properties		2 Permeability2	65 %	
StructureReductions1		+		
Permeabilities1	-	General		
E Workspace browser		📰 Results 📑 Properties		

Step 9 – Create Fluid



Fluid describes the intact fluid density in compartments.

By clicking the *Step* button, *Contents1* and *Fluid1* will be created automatically. Change the density to 900 kg/m³ and rename it to *Oil*.

Workspace browser 👻	φ×	Properties		- ↓ ×
🔺 🧮 Workspace	*	Contents1		
🔺 ቿ Environment	Ξ	Name	Density	Color
💼 Location1		1 Oil	900 kg/m^3	
🔺 📹 Properties		+		
StructureReductions1				
Permeabilities1				
Contents1		General		
🔄 Workspace browser		📻 Results 📑 Properti	es	

Step 10 – Create FillingFraction

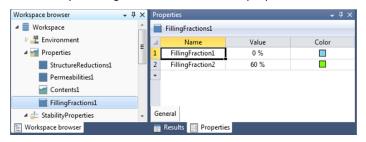


FillingFraction is used to specify how much a compartment is filled in intact condition, which may vary from 0% - 100%.

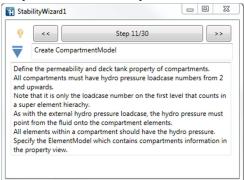
In this tutorial, define the *FillingFractions* as below.

Name	Filling Fraction
FillingFraction1	0%
FillingFraction2	60%

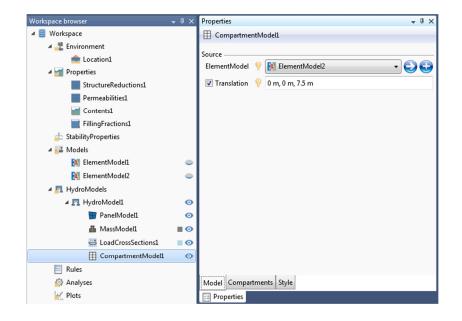
By clicking the *Step* button, *FillingFractions1* and *FillingFraction1* will be created automatically. And *FillingFraction2* can be created by clicking the "+" button in the *properties* window of *FillingFractions1*.



Step 11 – Create CompartmentModel



Similar to *PanelModel*, the model of compartments has been created in GeniE. In this tutorial, *EelementModel2* is used for the *CompartmentModel*. A translation of 7.5 m in z direction is applied.



All the compartments defined in Structure_T4.FEM will be listed in the *Compartments* tab of *Properties* window.

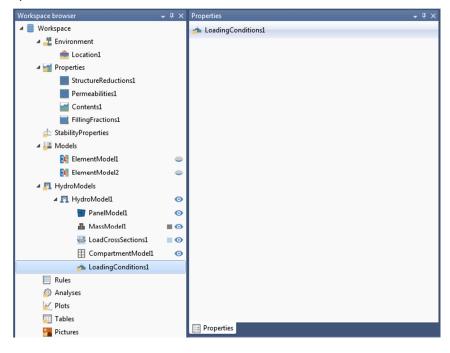
Define permeability and structure reduction of compartments as below and set compartments 10-17 as deck tanks.

	- ₽ ×		perties									•
Workspace		⊞	Compar	tmentMode	11							
🔺 💒 Environment			Selected	Loadcase#	Name	Group Permeability property	Permeability	Structure reduction property	Structure reduction	PlateThicknessCorrection	Deck tank	Visible
💼 Location1		1		2	LC2_TANK	Permeability2	65 %	StructureReduction2	30 %			
🔺 📹 Properties		2		3	LC3_TANK	Permeability2	65 %	StructureReduction2	30 %			
StructureReductions1		3		4	LC4_TANK	Permeability2	65 %	StructureReduction2	30 %			-
Permeabilities1		4		5	LC5_TANK	Permeability2	65 %	StructureReduction2	30 %			-
Contents1		5		6	LC6_TANK	Permeability2	65 %	StructureReduction2	30 %			J
		6		7	LC7_TANK	Permeability2	65 %	StructureReduction2	30 %			1
FillingFractions1		7		8	LC8_TANK	Permeability2	65 %	StructureReduction2	30 %			1
📥 StabilityProperties		8		9	LC9_TANK	Permeability2	65 %	StructureReduction2	30 %			V
4 🛺 Models		9		10	LC10_TAN	Permeability1	95 %	StructureReduction1	2 %		 Image: A set of the set of the	
🔁 ElementModel1	•	10		11	LC11_TAN	Permeability1	95 %	StructureReduction1	2 %		V	
ElementModel2		11		12	LC12_TAN	Permeability1	95 %	StructureReduction1	2 %		V	
A 🛐 HydroModels		12		13	LC13_TAN	Permeability1	95 %	StructureReduction1	2 %		V	
▲ MydroModel1	0	13		14	LC14_TAN		95 %	StructureReduction1	2 %		v	
,		14		15	LC15_TAN		95 %	StructureReduction1	2 %		 Image: A start of the start of	1
PanelModel1	Ο	15		16	LC16_TAN		95 %	StructureReduction1	2 %		 Image: A start of the start of	V
🚠 MassModel1	• •	16		17	LC17_TAN	Permeability1	95 %	StructureReduction1	2 %		V	1
😅 LoadCrossSections1	••	17		18	LC18_TAN		95 %	StructureReduction1	2 %			1
CompartmentModel1	0	18		19	LC19_TAN		95 %	StructureReduction1	2 %			1
Rules	-	19		20	LC20_TAN	Permeability1	95 %	StructureReduction1	2 %			1
		20		21	LC21_TAN	Permeability1	95 %	StructureReduction1	2 %			-
🎒 Analyses		21		22	LC22_TAN		95 %	StructureReduction1	2 %			-
📉 Plots		22		23	LC23_TAN	Permeability1	95 %	StructureReduction1	2 %			1
🛄 Tables												
Pictures		Mo	del Con	npartments	Style							



9	<<	Step 12/30	>>
	Create LoadingCo	onditions	
	ingConditions conc epts.	ept is a container to hold lo	ading condition

LoadingConditions is a container to hold a group of *LoadingCondition*. After it is created, we move to the next step directly.



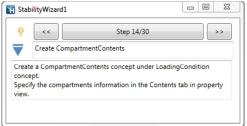
Step 13 – Create LoadingCondition



Add a *LoadingCondition* to the *LoadingConditions* which is created in the previous step, set *Waterline Z* to 22.5 m and rename the *LoadingCondition* to *LC_22_5*.

Workspace browser 🗸	Ψ×	Properties		≁ Ĥ ×
🔺 🧮 Workspace		📥 LC_22_5		
🔺 🚅 Environment		r		
💼 Location1		Environment – Location	0	🚔 Location1 🔹 🕤 🗗
4 📹 Properties		Location	Y	📥 Location1 🔹 😔 🚭
StructureReductions1		Specify By —		
Permeabilities1		Туре	9	Waterline & Trim
Contents1				Orafts
FillingFractions1		Waterline & Tr	im	
📥 StabilityProperties		Waterline Z	9	22.5 m
🔺 📥 Models		Trim	0	0 deg
🚺 ElementModel1	•			9
🚺 ElementModel2	۲	Drafts Draft AP	0	22.5 m
4 🛐 HydroModels			Y	
🔺 🋐 HydroModel1	Ο	Draft FP	Ŷ	22.5 m
冒 PanelModel1	o	Heel		
👗 MassModel1	• •	Heel	9	0 deg
🖶 LoadCrossSections1	• •			
CompartmentModel1	o			
🔺 📥 LoadingConditions1				
📥 LC_22_5 🛛 🥼	•			
🗐 Rules				
🎒 Analyses				
📈 Plots		Model Advar	_	a style
🔟 Tables		Properties		

Step 14 – Create CompartmentContents



CompartmentContents defines the fluid content of each compartment for a certain *LoadingCondition*.

Define *Fluid* and *Filling fraction* for each compartment as below.

orkspace browser	- ₽ ×	Pr	operties									-
Workspace		E	Compa	rtmentConte	ents1							
🔺 🚢 Environment		1	Selected	Name	Fluid	Fluid density	Filling property	Filling fraction	Intact fluid mass	Damaged	FreeSurface	Group
💼 Location1		1		LC2_TANK	Oil	900 kg/m^3	FillingFraction2	60 %	2.1262E+05 kg		V	LC2_TAN
🔺 📹 Properties		2		LC3_TANK	Oil	900 kg/m^3	FillingFraction2	60 %	2.1262E+05 kg			LC3_TAN
StructureReductions1		3		LC4_TANK	Oil	900 kg/m^3	FillingFraction2	60 %	2.1262E+05 kg		V	LC4_TAN
Permeabilities1		4		LC5_TANK	Oil	900 kg/m^3	FillingFraction2	60 %	2.1262E+05 kg			LC5_TANK
Contents1		5		LC6_TANK	Oil	900 kg/m^3	FillingFraction2	60 %	2.1262E+05 kg		v	LC6_TAN
FillingFractions1		6		LC7_TANK	Oil	900 kg/m^3	FillingFraction2	60 %	2.1262E+05 kg		V	LC7_TAN
-		7		LC8_TANK	Oil	900 kg/m^3	FillingFraction2	60 %	2.1262E+05 kg		V	LC8_TAN
📥 StabilityProperties		8		LC9_TANK	Oil	900 kg/m^3	FillingFraction2		2.1262E+05 kg		V	LC9_TAN
🛛 🏭 Models		9		LC10_TAN	Oil	900 kg/m^3	FillingFraction1	0 %	0 kg		V	LC10_TAN
🚺 ElementModel1	•	10		LC11_TAN	Oil	900 kg/m^3	FillingFraction1	0 %	0 kg		V	LC11_TAN
其 ElementModel2		11		LC12_TAN	Oil		FillingFraction1	0 %	0 kg		V	LC12_TAN
A 🛐 HydroModels		12		LC13_TAN	Oil		FillingFraction1	0 %	0 kg		V	LC13_TAN
▲ 🕅 HydroModel1	o	13		LC14_TAN	Oil		FillingFraction1	0 %	0 kg		V	LC14_TAN
,		14		LC15_TAN	Oil	-	FillingFraction1	0 %	0 kg		V	LC15_TAN
📅 PanelModel1	o	15		LC16_TAN	Oil		FillingFraction1	0 %	0 kg			LC16_TAN
👗 MassModel1	• •	16		LC17_TAN	Oil		FillingFraction1	0 %	0 kg		V	LC17_TAN
🖶 LoadCrossSections1	• •	17		LC18_TAN	Oil		FillingFraction2		5.1676E+05 kg		V	LC18_TAN
CompartmentModel1	ο	18		LC19_TAN	Oil	-	FillingFraction2	60 %	5.1676E+05 kg			LC19_TAN
🖌 📥 LoadingConditions1		19		LC20_TAN	Oil		FillingFraction2	60 %	5.1676E+05 kg			LC20_TAN
∠ → LC_22_5	₫ ∎ ⊙	20		LC21_TAN	Oil		FillingFraction2	60 %	5.1676E+05 kg			LC21_TAN
		21		LC22_TAN	Oil		FillingFraction2	60 %	3.1173E+05 kg			LC22_TAN
E CompartmentCo	ntents1 🧿	22		LC23_TAN	Oil	900 kg/m^3	FillingFraction2	60 %	3.1173E+05 kg		V	LC23_TAN
📃 Rules		C	ontonto (Options Sty	de							
🎒 Analyses				-	ic .							
V Plots			Properti	es								

A symbol of "unbalanced" shows on the right of *LC_22_5* in the *Workspace browser*, indicating the loading condition is not in equilibrium.

Step 15 - Adjusting filling CompartmentContents property view. Adjust filling through context menu on the CompartmentContents concept.

As *LC_22_5* is not in equilibrium, this step is to adjust the filling fraction of compartments.

By clicking the *Step* button, the *Properties* window - *Options* tab of *CompartmentContents* is activated. Select "Adjust by *compartment"* and set *Adjustable* for compartments 2~10.

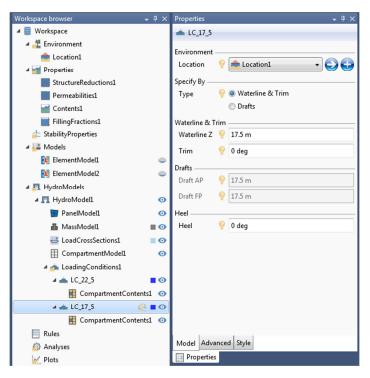
In the context menu of *CompartmentContents*, run the command *Adjusting filling*. The filling fraction of adjustable compartments will be adjusted automatically, so that *LC_22_5* is in equilibrium.

orkspace browser 🗸 🕂 🗙	Prop	erties				+				
Workspace		Compartment	Contents1							
🔺 🚢 Environment	Min/	Max filling frac	tion							
💼 Location1		Min Viol 0 % Max Viol 100 %								
🔺 📷 Properties										
StructureReductions1	Ma									
Permeabilities1	Adju	Adjust filling								
Contents1	Тур	Type 🤗 💿 Adjust by compartment								
FillingFractions1		Õ	Adjust by grou	þ						
📥 StabilityProperties	Exh	austive 🖗 🔽	1							
🔺 🛺 Models										
🚺 ElementModel1 🛛 🔍	lim	neout 💡 6	0							
🚺 ElementModel2 🛛 🗢	Com	partment setti	ngs							
A 🛐 HydroModels		Name	Fluid density	Filling fraction	Damaged	Adjustable				
	1	LC2_TANK	900 kg/m^3	60 %		V				
,	2	LC3_TANK	900 kg/m^3	60 %						
PanelModel1 💿	-	LC4_TANK	900 kg/m^3	60 %						
👗 MassModel1 🛛 🔳 💿		LC5_TANK	900 kg/m^3	60 %		V				
🖶 LoadCrossSections1 🛛 🔳 🧿	5	LC6_TANK	900 kg/m^3	60 %						
🗄 CompartmentModel1 🛛 🧿	6	LC7_TANK	900 kg/m^3	60 %						
🖌 📥 LoadingConditions1	7	LC8_TANK	900 kg/m^3	60 %						
🔺 📥 LC 22 5 🛛 🕼 🔳 🧿		LC9_TANK	900 kg/m^3 900 kg/m^3	60 %		✓ ✓				
E CompartmentContents1 0		LC11_TAN	900 kg/m ³	0 %						
Rules Adjust filling	11	LC12_TAN	900 kg/m^3	0 %						
	12	LC13_TAN	900 kg/m^3	0 %						
Manalys - Kename	13	LC14_TAN	900 kg/m^3	0 %						
Plots 🔏 Cut	14	LC15_TAN	900 kg/m^3	0 %						
Tables Copy	15	LC16_TAN	900 kg/m^3	0 %						
Picture Victore	16	LC17_TAN	900 kg/m^3	0 %						
Report X Delete	17	LC18_TAN	900 kg/m^3	60 %						
🔺 👰 ViewS 🧴 Paste	18	LC19_TAN	900 kg/m^3	60 %						
🔺 🚔 Vie Visibility 🕨	19	LC20_TAN	900 kg/m^3	60 %						
	20	LC21_TAN	900 kg/m^3	60 %						
✓ Wizards	21	LC22_TAN	900 kg/m^3	60 %						
StabilityWizard1	22	LC23_TAN	900 kg/m^3	60 %						
5 Stability Wizardi										
	Con	tents Options	Style							

Before we go to next step, we add one more *LoadingCondition*.

Copy *LC_22_5* and paste it to the parent folder *LoadingConditions1*

Change *Waterline Z* of the pasted *LoadingCondition* to 17.5 m and rename it to *LC_17_5*.



For *LC_17_5*, set *Adjustable* for compartments 2~10 and 18~21.

In the context menu of *CompartmentContents*, run the command *Adjusting filling*. The filling fraction of adjustable compartments will be adjusted automatically, so that *LC_17_5* is in equilibrium.

		×	FIU	perties				▼ 4	џ >
💼 Location1		*		Compartmen	tContents1				
Properties				Name	Fluid density	Filling fraction	Damaged	Adjustable	1 P
StructureReductions1			1	LC2 TANK	900 kg/m^3	100 %	Dunnaged		1
Permeabilities1			2	LC3 TANK	900 kg/m^3	0 %		V	
Contents1			3	LC4_TANK	900 kg/m^3	40.0891 %		1	
FillingFractions1			4	LC5_TANK	900 kg/m^3	100 %		1	1
✓ ▲ StabilityProperties			5	LC6_TANK	900 kg/m^3	100 %		V	1
* HeelAngles1			6	LC7_TANK	900 kg/m^3	40.0887 %		V	1
			7	LC8_TANK	900 kg/m^3	0 %		1	
A A Models		Ξ	8	LC9_TANK	900 kg/m^3	100 %		V	
🔯 ElementModel1	-		9	LC10_TAN	900 kg/m^3	0 %		v	1
🚺 ElementModel2			10	LC11_TAN	900 kg/m^3	0 %			
▲			11	LC12_TAN	900 kg/m^3	0 %			
⊿ 🖪 HydroModel1			12	LC13_TAN	900 kg/m^3	0 %			l
PanelModel1	Ŧ	Ad	just f	illing	00 kg/m^3	0 %			
MassModel1	e e		name		00 kg/m^3	0 %			
	-P	Ker	name	10	00 kg/m^3	0 %			
LoadCrossSections1	X	Cu	ŧ.		00 kg/m^3	0 %			
CompartmentModel1					00 kg/m^3	60 %			l
🛯 📥 LoadingConditions1	6	Co			00 kg/m^3	60 %			
4 📥 LC_22_5	×	Del	lete		00 kg/m^3	60 %			
CompartmentContents	6	Pas	ste		00 kg/m^3	60 %		7	
🖌 📥 LC 17.5					00 kg/m^3	60 %			
			ibility		00 kg/m^3	60 %			
CompartmentContents		٣	0	option	15 Style				

Step 16 – Create DamageCases

?	<<	Step 16/30		>>
7	Create Damage	Cases		
m	ageCases concept	is container of damage case co	oncepts.	

DamageCases is a container to hold a group of *DamageCase*. After it is created, we move to the next step directly.

Workspace browser 🛛 🗸 🕂 🗙	Properties 👻 🕂 🗙
🔺 🧮 Workspace	🗄 DamageCases1
🔺 💒 Environment	
💼 Location1	
🔺 📷 Properties	
StructureReductions1	
Permeabilities1	
Contents1	
FillingFractions1	
📥 StabilityProperties	
🔺 🎿 Models	
🚺 ElementModel1 🛛 🔍	
🚺 ElementModel2 🛛 🔍	
4 🛐 HydroModels	
⊿ 🖪 HydroModel1 💿	
🕎 PanelModel1 💿	
👗 MassModel1 🛛 🔳 🧿	
🖶 LoadCrossSections1 🛛 🔳 💿	
CompartmentModel1 O	
🔺 📥 LoadingConditions1	
4 📥 LC_22_5 📃 💿	
🚦 CompartmentContents1 🧿	
4 📥 LC_17_5 📃 🧿	
🚦 CompartmentContents1 💿	
DamageCases1	
📃 Rules	
🎒 Analyses	
🔀 Plots	
🛄 Tables	Properties

Step 17 – Create DamageCase



DamageCase defines a damage case for the compartments.

In the tutorial, we set *LC9_TANK* and *LC23_TANK* as damaged.

orkspace browser 🚽 🕂	× Prop	erties		→ [
🛯 🧮 Workspace		DamageCase1		
🔺 <u>द</u> Environment		Selected	Compartment	Damaged
💼 Location1	1		LC2_TANK	
🔺 📷 Properties	2		LC3_TANK	
StructureReductions1	3		LC4_TANK	
Permeabilities1	4		LC5_TANK	
Contents1	5		LC6_TANK	
FillingFractions1	6		LC7_TANK	
	7		LC8_TANK	
StabilityProperties	8		LC9_TANK	
🔺 🕌 Models	9		LC10_TAN	
📴 ElementModel1 🛛 🔍	10		LC11_TAN	
🚺 ElementModel2 🛛 🔍	11		LC12_TAN	
4 🛐 HydroModels	12		LC13_TAN	
	13		LC14_TAN	
	14		LC15_TAN	
	1.5		LC16_TAN	
👗 MassModel1 🛛 🔳 🔇	47		LC17_TAN	
🛁 LoadCrossSections1 🛛 🔤 🔇			LC18_TAN	
🗄 CompartmentModel1 🛛 🔇	18 19		LC19_TAN	
4 📥 LoadingConditions1	20		LC20_TAN LC21_TAN	
4 📥 LC_22_5			LC21_TAN	
CompartmentContents1	21		LC22_TAN	
			LC25_TAIN	V
⊿ <u>⇔</u> LC_17_5 ■ <				
🗄 CompartmentContents1 <				
🔺 🛅 DamageCases1	Mod	del Style		
🕂 DamageCase1 🔍) 🗐 P	Properties		

Step 18 – Create Openings



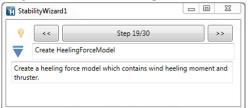
Flooding openings are connected to compartment. If an opening is submerged, the connected compartment will be flooded if the opening is not watertight.

In this tutorial, an Opening is defined at point (0 m, -9.5 m, 41 m) and connected to LC16_TANK.

By clicking the Step button, Openings1 and SingleOpening1 will be created automatically.

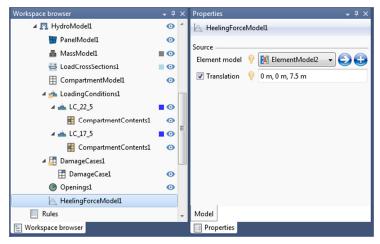
Workspace browser	→ Ĥ	×	Pro	perties							- 4 ×
🔺 🛐 HydroModels		*	0	Openings1							_
⊿ 🛐 HydroModel1	o			Name	Туре	Position X	Position Y	Position Z	Connected	Visible	Direction
PanelModel1	O		1	SingleOpening1	Unprotected	0 m	-9.5 m	41 m	LC16_TAN		1,0,0
👗 MassModel1	••		+								
🖶 LoadCrossSections1	• •										
CompartmentModel1	o										
4 📥 LoadingConditions1											
4 📥 LC_22_5	•										
CompartmentContents1	O	Ξ									
4 📥 LC_17_5	•										
CompartmentContents1	o										
🔺 🛅 DamageCases1											
DamageCase1	o										
Openings1	0										
🗐 Rules		÷	Op	enings							
🔚 Workspace browser				Properties							



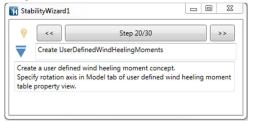


HeelingForceModel defines the heeling forces for stability analysis.

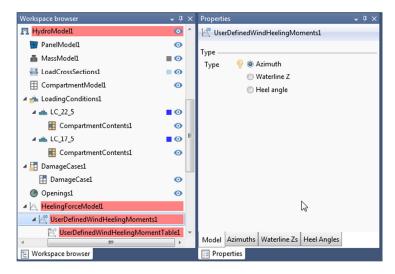
ElementModel2 is selected as the structure to hold wind and thrust force, and a translation of 7.5 m in z direction is applied.



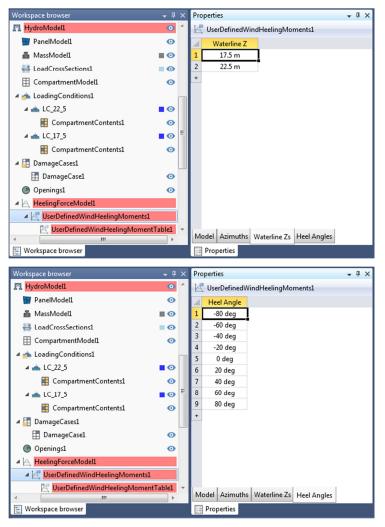
Step 20 – Create UserDefinedWindHeelingMoments



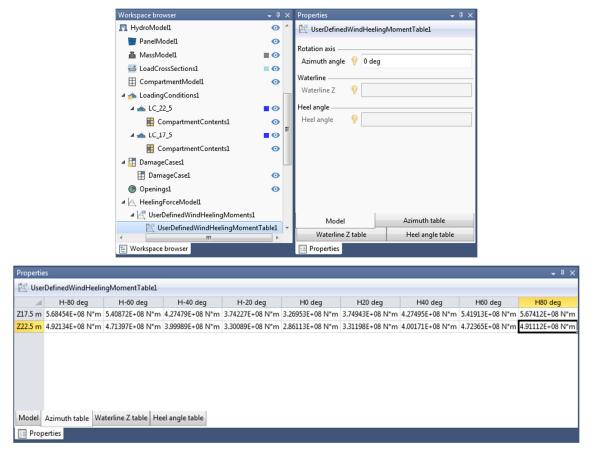
In this tutorial, the wind heeling moments are specified by the user which could be obtained from wind tunnel experiment. "Azimuth" type is used, which means each table is corresponding to an azimuth and contains the heeling moments for each waterline Z and heel angle.



Define 2 waterlines and 9 heel angles.



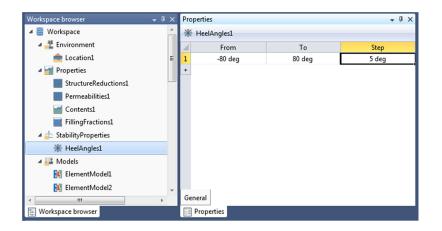
In this tutorial, we only have one wind heeling moment table for azimuth = 0 deg, and the values are shown as below.



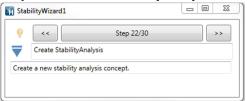
Step 21 – Create HeelAngles



HeelAngles is used for GZ curve calculation, as well the wind heeling moments calculated by HydroD. In this tutorial we define the heel angles from -80 deg to 80deg with a 5 deg step.



Step 22 – Create StabilityAnalysis



In this tutorial, we define the *StabilityAnalysis* as below.

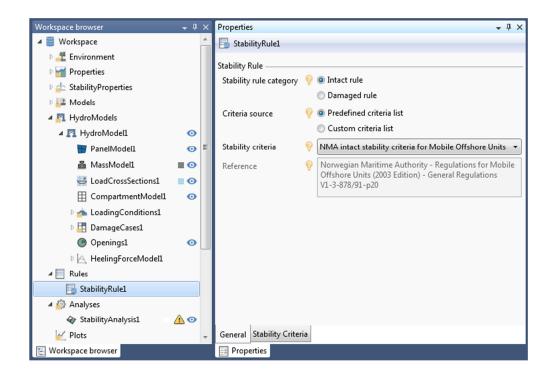
Workspace browser	→ 4 ×	Properties	•	Ψ×
🔺 🧮 Workspace		♦ StabilityAnalysis1		
🖻 🚰 Environment		Load cases		
Properties		Hydro model	💡 🖪 HydroModel1 🛛 🗸 🂽	
🛚 📩 StabilityProperties				•
🛚 🔐 Models		Defined by	💡 🔘 LoadingCondition	
4 🛐 HydroModels			Output Conditions	
4 🖪 HydroModel1	Ο	Loading condition	· · · · · · · · · · · · · · · · · · ·	Ð
📷 PanelModel1	O	Loading conditions	💡 📥 LoadingConditions1 🛛 👻 😜	(
🚠 MassModel1	• •	Damage cases	💡 🖪 DamageCases1 🔹 🌄	
😅 LoadCrossSections1	Ø			
☐ CompartmentModel1	Ο	Heeling Force Model ——		
🛛 📥 LoadingConditions1		Heeling force model	💡 📐 HeelingForceModel1 🛛 👻 😂	Ð
🛛 🛅 DamageCases1		Heeling force angles	•	Ð
Openings1	o	Heeling force azimuth	Ŷ	•
Image: Part Part Part Part Part Part Part Part		Rotation axis		_
📃 Rules		Auto detect rotation axis	0	
🛯 🎒 Analyses				
♦ StabilityAnalysis1	⊙	Azimuth angles	Azimuth 1 0 deg	
📈 Plots			+	
🕎 Tables				
Pictures		Heel angles		
🖺 Reports		Heel angles	💡 🋞 HeelAngles1 🔹 🗸	
🔺 🙊 ViewSettings				
🔺 🚔 ViewSetting1				
🚔 HydroViewSetting1				
🔺 武 Wizards				
💦 StabilityWizard1		General Options Style		
🔚 Workspace browser		Properties		



9	<<	Step 23/30	>>
7	Create StabilityR	tule (Intact)	
reat	te a new StabilityR	ule concept. (Intact)	

In this step, a *StabilityRule* is defined for the intact stability rule check.

We use NMA intact stability criteria in the tutorial.

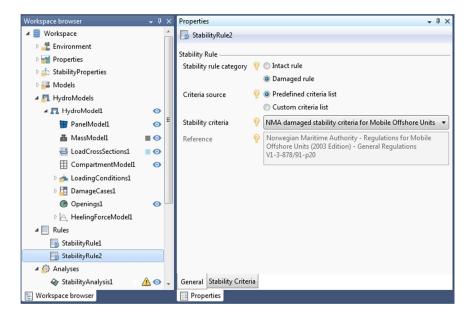


Step 24 - Create StabilityRule (Damaged)



In this step, a *StabilityRule* is defined for the damaged stability rule check.

We use NMA damaged stability criteria in the tutorial.



Step 25 – Create StabilityRuleCheck

		Step 25/30	>	>
Crea	te StabilityRule	Check		_
Create a ne	w StabilityRule	Check concept.		

StabilityRuleCheck refers to one or several StabilityAnalysis. It will do the rule check with respect to the selected rules for each loading condition, after the StabilityAnalysis is executed successfully.

In this tutorial, the *StabilityRuleCheck* is defined as below.

Workspace browser	🗕 🕂 🕂	×	Properties		+ Ț ×
🛚 🕂 Environment		*	📑 StabilityRuleCh	neck	1
🛛 📷 Properties					
🛚 📥 StabilityProperties			Input	0	StabilityAnalysis1
🛛 🚢 Models			Stability analyses	Y	stabilityAnalysis1 •
4 🛐 HydroModels			Intact stability rule	_	
🔺 🋐 HydroModel1	0		Rule	9	🔄 StabilityRule1 🔹 🗸 🔂
🕎 PanelModel1	o		Reference	9	Norwegian Maritime Authority - Regulations for Mobile Offshore
👗 MassModel1					Units (2003 Edition) - General Regulations V1-3-878/91-p20
👑 LoadCrossSections1	• •				
CompartmentModel1	o				
🛛 📥 LoadingConditions1			Damage stability ru	le –	
DamageCases1			Rule	Y	🖪 StabilityRule2 🔹 🔾 🔂
Ø Openings1	0		Reference	9	Norwegian Maritime Authority - Regulations for Mobile Offshore Units (2003 Edition) - General Regulations V1-3-878/91-p20
Image: Part Part Part Part Part Part Part Part					onits (2005 Edition) - General Regulations v1-5-070/51-p20
🔺 🧮 Rules					
🔄 StabilityRule1					
🔄 StabilityRule2					
4 🎒 Analyses					
🔷 StabilityAnalysis1	<u>∧</u> ⊙				
📑 StabilityRuleCheck1	Δ	-	General		
E Workspace browser			Properties		

Step 26 – Create StrengthAnalysis

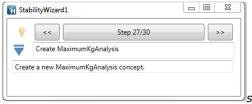
V <<	Step 26/30	>>
Create StrengthAnalysis		

StrengthAnalysis is for the calculation of forces and moments on cross sections in still water.

Similar to *StabilityAnalysis*, we define the *StrengthAnalysis* by *LoadingConditions1* combined with *DamageCases1*.

Workspace browser	÷ û	×	Properties		- ų ×
🛛 📥 StabilityProperties		*	StrengthAnalysis	1	
🛛 🕌 Models			Load cases		
4 🛐 HydroModels			Hydro model	💡 🖳 HydroModel1	-00
⊿ 🖪 HydroModel1	0			•	
📷 PanelModel1	0		Defined by	💡 🔘 LoadingCondition	
👗 MassModel1				LoadingConditions	
🖶 LoadCrossSections1	• •		Loading condition	8	
CompartmentModel1	0	ш	Loading conditions	💡 📥 LoadingConditions1	- 00
🛛 📥 LoadingConditions1		-	Damage cases	💡 🖪 DamageCases1	
🛛 🔚 DamageCases1				v	
Øpenings1	0				
HeelingForceModel1					
🔺 🧮 Rules					
🔄 StabilityRule1					
🔄 StabilityRule2					
🔺 🎒 Analyses					
♦ StabilityAnalysis1	<u>Λ</u> ο				
📑 StabilityRuleCheck1					
StrengthAnalysis1	Δ				
K Plots		-	General Option		
🗄 Workspace browser			Properties		

Step 27 – Create MaximumKgAnalysis



MaximumKgAnalysis is to calculate the maximum KG for a range of waterlines and azimuths with respect to intact and damage stability rule.

In this tutorial, a *MaximumKgAnalysis* is defined as below.

Workspace browser 🗸	ìΧ	Properties		≁ ‡ ×
🔺 🧮 Workspace		📅 MaximumKgAnalys	is1	
🛚 🗮 Environment		Model		
🛛 📷 Properties		Location	0	📥 Location1 🔹 🍙 🛟
🔺 🚋 StabilityProperties			Y	
₭ HeelAngles1		Hydro model	9	🖪 HydroModel1 🔹 🌍 🚭
🔺 🚅 Models		Orientation		
🚺 ElementModel1	0	Heel	9	0 deg
🚺 ElementModel2	Ο	Trim	0	0 deg
🔺 🛐 HydroModels		Waterlines	0	Waterline Z
⊿ 🖪 HydroModel1	Ο	waterinies	۷	1 17.5 m
📷 PanelModel1	0			2 19.5 m
AmassModel1	0			3 21.5 m
🖶 LoadCrossSections1	0			4 23.5 m 5 25.5 m
CompartmentModel1	0			5 25.5 m 6 27.5 m
🛚 📥 LoadingConditions1				+
4 📥 LC_22_5	0			
CompartmentContents1	Ο	Stability analysis setting	s —	
⊿ 📥 LC_17_5	0	Azimuth angles	9	Azimuth
CompartmentContents1	Ο			1 0 deg
🔺 🛅 DamageCases1				2 45 deg
DamageCase1	Ο			3 90 deg
Openings1	Ο			•
🔺 🖳 HeelingForceModel1		Heel angles	0	🛞 🕞
▲ Keiner Aussen Aus		Heel angles	۷	🛞 HeelAngles1 🔹 🕄 🔂
🖄 UserDefinedWindHeelingMomentTable	1	Heeling Force Model —	~	
A 📃 Rules		Heeling force model	Ÿ	🔄 HeelingForceModel1 🔹 🌍 🚭
StabilityRule1		Heeling force angles	9	
🔚 StabilityRule2		Intact stability		
4 🚳 Analyses		Rule	ø	🗟 StabilityRule1 🔹 🌍 🛟
	0	Reference	0	Norwegian Maritime Authority -
StabilityRuleCheck1		herenee	Ť	Regulations for Mobile Offshore Units (2003
StrengthAnalysis1				Edition) - General Regulations V1-3-878/91- p20
maximumKgAnalysis1				
2 Plots		Damage stability ——		
Tables		Include damage cases	Ŷ	
Pictures		Damage	9	🖪 DamageCases1 🔹 🌍 🛟
A Reports		Rule	0	🗟 StabilityRule2 -
ViewSettings			0	
ViewSetting1		Reference	۷	Norwegian Maritime Authority - Regulations for Mobile Offshore Units (2003
HydroViewSetting1 A X Wizards				Edition) - General Regulations V1-3-878/91- p20
Wizards StabilityWizard1				para la construcción de la const
3 Stability Wizardi		Model Options		
I Warkensco browser			_	
E Workspace browser		Properties		

Step 28 - Run StabilityAnalysis

9	<<	Step 28/30	>>
	Run StabilityAnaly	ysis	
Exect conc		he context menu of the sta	ability analysis

Click the *Step* button, then *StabilityAnalysis1* will run and the progress information is shown in the *Activity monitor* window.

StabilityRuleCheck1, which refers to *StabilityAnalysis1*, will run automatically after *StabilityAnalysis1* is completed.

Step 29 – Run StrengthAnalysis

Due Streeth Andreis	
Run Strength Analysis	
Execute the analysis on the context menu of strength a	alvsis concent.

Click the Step button to run StrengthAnalysis.

Step 30 – Run MaximumKGAnalysis

0	bilityWizard1	Step 30/30		>>
▼	Run Maximum	KgAnalysis		
Exect		n the context menu of Maximu	ımKG ana	lysis

Click the Step button to run *MaximumKgAnalysis*.

After all the analyses are completed, the Activity monitor would look as below.

Status	Source	Description	Progress	Duration	Time left
\bigcirc	MaximumKgAnalysis1	The calculation completed successfu	100.0 %	00:00:43	00:00:00
\bigcirc	StrengthAnalysis1	Calculation completed successfully.	100.0 %	00:03:30	00:00:00
\bigcirc	StabilityAnalysis1	Calculation completed successfully.	100.0 %	00:00:01	00:00:00

R Activity monitor

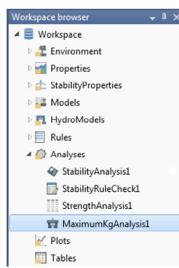
4 VIEW RESULTS

As all the analyses are completed, the results could be viewed in the *Results* window of corresponding analysis.

For *StabilityAnalysis*, *StabilityRuleCheck* and *StrengthAnalysis*, the results of each *LoadingCondition* could be shown by selecting the corresponding *LoadingCondition* from the dropdown list on the top right of *Results* window.

Workspace browser	- Д	× Re	sults								- ₽×
🛿 🧮 Workspace		- 9	Stability	Analysis1						LC_22_5	/ A0 deg 🔻 🛅
🛛 🗮 Environment			Angle	GZ	Righting moment	Righting moment area	Heeling moment	Heeling moment area	Trim	WaterlineZ	GZ w/o deck t
🛚 📷 Properties		1	-80 deg	-7.27914 m	-1.83108E+09 N*m	-2.83501E+09 N*m*rad	-	5.55224E+08 N*m*rad	-46.8232 deg	1.75238 m	-2.07733 n
🛛 📩 StabilityProperties		2	-75 deg	-7.85655 m	-1.97633E+09 N*m	-2.66888E+09 N*m*rad	4.8695E+08 N*m	5.12503E+08 N*m*rad	-45.6945 deg	3.14999 m	-2.84202 m
D 🚽 Models		3	-70 deg	-8.45592 m	-2.1271E+09 N*m	-2.48983E+09 N*m*rad	4.81766E+08 N*m	4.70235E+08 N*m*rad	-44.2738 deg	4.59237 m	-3.67765 n
▲ I HydroModels		4	-65 deg	-9.09922 m	-2.28892E+09 N*m	-2.29715E+09 N*m*rad	4.76581E+08 N*m	4.28419E+08 N*m*rad	-42.4795 deg	6.0931 m	-4.60073 m
A R HydroModel1	o	5	-60 deg	-9.84469 m	-2.47645E+09 N*m	-2.08922E+09 N*m*rad	4.71397E+08 N*m	3.87056E+08 N*m*rad	-40.0549 deg	7.66197 m	-5.67157 n
,	-	6	-55 deg	-10.8164 m	-2.72089E+09 N*m	-1.86244E+09 N*m*rad	4.53545E+08 N*m	3.46698E+08 N*m*rad	-36.4325 deg	9.47709 m	-6.99565 n
PanelModel1	0	7	-50 deg	-13.0934 m	-3.29366E+09 N*m	-1.60001E+09 N*m*rad	4.35693E+08 N*m	3.07897E+08 N*m*rad	-27.996 deg	12.5497 m	-9.61569 n
A MassModel1	••	8	-45 deg	-18.3562 m	-4.61753E+09 N*m	-1.25482E+09 N*m*rad	4.17841E+08 N*m	2.70655E+08 N*m*rad	-2.0896E-02 deg	18.4911 m	-15.1488 n
🛁 LoadCrossSections1	••	9	-40 deg	-16.3862 m	-4.12197E+09 N*m	-8.73483E+08 N*m*rad	3.99989E+08 N*m	2.3497E+08 N*m*rad	-7.1045E-03 deg	18.9992 m	-13.4057 m
CompartmentModel1	o	10	2	-12.9795 m	-3.26501E+09 N*m	-5.51165E+08 N*m*rad	3.82514E+08 N*m	2.00827E+08 N*m*rad	-3.9384E-03 deg	19.4202 m	-10.6691 n
LoadingConditions1		11		-8.18856 m	-2.05984E+09 N*m	-3.18824E+08 N*m*rad	3.65039E+08 N*m	1.68209E+08 N*m*rad	-2.88658E-03 deg	19.9617 m	-7.00679 n
▷ 📥 LC_22_5	0	12		-4.21133 m	-1.05937E+09 N*m	-1.82723E+08 N*m*rad		1.37116E+08 N*m*rad	-3.61456E-03 deg	20.5324 m	-3.93888 m
		13	2	-2.64464 m	-6.65263E+08 N*m	-1.07472E+08 N*m*rad			-5.07007E-03 deg		-2.64464 n
LC_17_5	••	14		-1.82959 m	-4.60236E+08 N*m	-5.83629E+07 N*m*rad		7.92215E+07 N*m*rad	-4.30074E-03 deg		-1.82959 n
🔺 🛅 DamageCases1		15		-1.17034 m	-2.94401E+08 N*m	-2.54356E+07 N*m*rad	3.08101E+08 N*m	5.1855E+07 N*m*rad	-3.02962E-03 deg		-1.17034 n
📑 DamageCase1	ο	≡ 16		-0.573524 m	-1.44271E+08 N*m	-6.29498E+06 N*m*rad		2.54478E+07 N*m*rad	-1.51689E-03 deg		-0.573524 r
Openings1	0	17		1.78091E-06 m	447.992 N*m	0 N*m*rad	2.86113E+08 N*m	0 N*m*rad	0 deg	22.5 m	1.78091E-06
▷ A HeelingForceModel1		18	-	0.573527 m	1.44272E+08 N*m	6.29506E+06 N*m*rad		2.54599E+07 N*m*rad	1.51666E-03 deg	22.4138 m	0.573527 n
A E Rules		19		1.17034 m	2.94402E+08 N*m	2.54358E+07 N*m*rad		5.19033E+07 N*m*rad	3.02922E-03 deg	22.1541 m	1.17034 m
		20		1.82959 m	4.60237E+08 N*m	5.83631E+07 N*m*rad			4.30042E-03 deg	21.7395 m	1.82959 m
🔄 StabilityRule1		21		2.64464 m	6.65264E+08 N*m	1.07472E+08 N*m*rad		1.07741E+08 N*m*rad	5.07056E-03 deg	21.2609 m	2.64464 m
🔚 StabilityRule2		22		4.21133 m	1.05937E+09 N*m	1.82724E+08 N*m*rad		1.37396E+08 N*m*rad	3.61321E-03 deg	20.5324 m	3.93888 m
🔺 🎒 Analyses		23		8.18856 m	2.05985E+09 N*m	3.18825E+08 N*m*rad	3.65685E+08 N*m	1.68556E+08 N*m*rad	2.88739E-03 deg	19.9617 m	7.0068 m
ItabilityAnalysis1	•	24		12.9795 m	3.26501E+09 N*m	5.51165E+08 N*m*rad	3.82928E+08 N*m	2.0122E+08 N*m*rad	3.93956E-03 deg	19.4202 m	10.6691 m
📑 StabilityRuleCheck1		25		16.3862 m	4.12197E+09 N*m	8.73483E+08 N*m*rad		2.35389E+08 N*m*rad	7.10786E-03 deg	18.9992 m	13.4057 m
StrengthAnalysis1		26		18.3562 m	4.61753E+09 N*m	1.25482E+09 N*m*rad		2.71098E+08 N*m*rad	2.08947E-02 deg	18.4911 m	15.1488 m
maximumKqAnalysis1		27	5	13.1062 m	3.29689E+09 N*m	1.60015E+09 N*m*rad			-27.9729 deg	12.5543 m	9.62888 m
		28 29		10.8284 m	2.72389E+09 N*m	1.86285E+09 N*m*rad		3.47241E+08 N*m*rad	-36.4216 deg	9.47898 m	7.00785 m
2 Plots				9.85823 m	2.47985E+09 N*m	2.08991E+09 N*m*rad		3.87675E+08 N*m*rad	-40.0477 deg	7.66285 m	5.68538 m
Tables		30 31		9.11453 m	2.29277E+09 N*m	2.29815E+09 N*m*rad		4.29101E+08 N*m*rad	-42.474 deg	6.09372 m	4.61624 m
Pictures		31		7.46261 m 6.82607 m	1.87723E+09 N*m 1.71711E+09 N*m	2.48011E+09 N*m*rad 2.63694E+09 N*m*rad		4.70937E+08 N*m*rad 5.13181E+08 N*m*rad	-43.285 deg	5.78462 m 4.37649 m	3.88277 m 3.06524 m
E Reports		32							-44.6299 deg		
🔺 🚔 ViewSettings	l	33	80 deg	6.22933 m	1.567E+09 N*m	2.78023E+09 N*m*rad	4.91112E+08 N°m	5.55834E+08 N*m*rad	-45.6293 deg	3.01399 m	2.3057 m
4 🚔 ViewSetting1			٠ -			"					
HydroViewSetting1		- In	formation	Results Heeli	ng moments Interc	eptions Openings					
Workspace browser			Results		-						
			Results								

🛢 Workspace			St.	abilityRuleCh	eck1					StabilityAnalysis1 LC_22_5 / A0 deg					
🛚 🕂 Environment					Criterion			Compare		With		Actual value	Comparison	Required value	Resu
Properties			1 n in	clination and		must not exceed	Equilibriu			x. allowed equilibrium inclination angle with wi			<=	17 deg	PAS
StabilityProperties				2 Second righting/heeling moment intercept					Min. allowed value for se		Infinity	>	30 deg	PAS	
🛛 🔜 Models			3	Positiv	ve righting n	noment	ghting mome	nts from upright to seco	ond interce	All values are po		True	=	True	PAS
Interview Provide P			4		stacentric he			Metacentric height		Min. metacentric		6.524 m	>=	1 m	PAS
E Rules			5	Righting ar	rea excess of	heeling area		Righting area		1.3 * Wind heelin	g area	2.32569E+09 N*m*rad	>	5.65381E+08 N*m*rad	PAS
Analyses															
StabilityAnalysis1			-												
StabilityRuleCheck1															
StrengthAnalysis1															
1 MaximumKgAnalysis1															
Plots															
Tables															
Pictures															
A Reports															
Nepold															
▷ 🗙 Wizards			-												_
					letails Com	puted Values Te	xt								
Workspace browser			Re:	sults											
Vorkspace browser 🚽 🕂	× Resu	ults													- 4
4 🧮 Workspace	1 III	StrengthAna	alysis1										Stre	engthAnalysis1_LC_22	25 -
🛚 🗮 Environment		Plane	Side	Х	Y	Z	Total FX	Total FY	Total F	Z Total MX	Total MY	Total MZ	Buoyancy F	X Buoyancy FY	
Properties		YZ	Positive	-50 m	0 m		0284E-08 N	3.08501E-09 N	1.19209E-		0.598467 N*m		6.40284E-08		
StabilityProperties	2	YZ	Positive	-49.8 m	0 m		0284E-08 N	3.08501E-09 N	1.49012E-0		0.598438 N*m		6.40284E-08		
Models	3	YZ	Positive	-49.6 m	0 m		0284E-08 N	3.08501E-09 N	1.19209E-0		0.598459 N*m		6.40284E-08		
	4	YZ	Positive	-49.4 m	0 m		0284E-08 N	3.08501E-09 N	1.78814E-0		0.598475 N*m				
⊿ 🛐 HydroModels	5	YZ	Positive	-49.2 m	0 m		0284E-08 N	3.08501E-09 N	2.08616E-0		0.59848 N*m	2.31899E-07 N*m	6.40284E-08		
🔺 🖪 HydroModel1 🛛 💿	6	YZ	Positive	-49 m	0 m		0284E-08 N	3.08501E-09 N	2.38419E-0		0.598446 N*m				
PanelModel1 💿	7	YZ	Positive	-48.8 m	0 m		0284E-08 N	3.08501E-09 N	1.49012E-0		0.598429 N*m				
🛔 MassModel1 🛛 🔳 💿	8	YZ	Positive	-48.6 m	0 m		0284E-08 N	3.08501E-09 N	2.98023E-		0.59844 N*m	-5.72763E-07 N*m			
LoadCrossSections1 🛛 💿	9	YZ	Positive	-48.4 m	0 m		0284E-08 N		1.78814E-0		0.598431 N*m		6.40284E-08		
CompartmentModel1 0	10	YZ	Positive	-48.2 m	0 m		0284E-08 N	3.08501E-09 N	1.19209E-0		0.598461 N*m		6.40284E-08		
	11	YZ	Positive	-48 m	0 m	0 m 6.4	0284E-08 N	3.08501E-09 N	1.78814E-0	07 N -447.992 N*m	0.598484 N*m	-5.3551E-07 N*m	6.40284E-08		
🔺 📥 LoadingConditions1	12	YZ	Positive	-47.8 m	0 m	0 m 6.4	0284E-08 N	3.08501E-09 N	1.78814E-0	07 N -447.992 N*m	0.598442 N*m	-4.19095E-07 N*m	6.40284E-08	N 3.08501E-09 N	4 2
Þ 📥 LC_22_5 🛛 🗖 💿	13	YZ	Positive	-47.6 m	0 m	0 m 6.4	0284E-08 N	3.08501E-09 N	1.78814E-0	07 N -447,992 N*m	0.598436 N*m	1.71363E-07 N*m	6.40284E-08	N 3.08501E-09 N	1 2
Þ 📥 LC_17_5 🛛 🗖 💿	14	YZ	Positive	-47.4 m	0 m		0284E-08 N	3.08501E-09 N	1.49012E-0		0.598455 N*m		6.40284E-08		
⊿ 🔚 DamageCases1	15	YZ	Positive	-47.2 m	0 m		0284E-08 N	3.08501E-09 N	1.49012E-0		0.59845 N*m	-1.02445E-08 N*m	6.40284E-08		
DamageCase1 O	16	YZ	Positive	-47 m	0 m	0 m 6.4	0284E-08 N	3.08501E-09 N	5.96046E-0	08 N -447.992 N*m	0.598454 N*m	1.54041E-06 N*m	6.40284E-08	N 3.08501E-09 N	1 2
	17	YZ	Positive	-46.8 m	0 m		0284E-08 N	3.08501E-09 N	5.96046E-0		0.598465 N*m				
Openings1 O	18	YZ	Positive	-46.6 m	0 m		0284E-08 N	3.08501E-09 N	2.08616E-		0.598452 N*m		6.40284E-08		
HeelingForceModel1	19	YZ	Positive	-46.4 m	0 m	0 m 6.4	0284E-08 N	3.08501E-09 N	2.38419E-0		0.598457 N*m		6.40284E-08		
a 📃 Rules	20	YZ	Positive	-46.2 m	0 m	0 m 6.4	0284E-08 N	3.08501E-09 N	2.08616E-0		0.598461 N*m	-4.33065E-07 N*m	6.40284E-08		
StabilityRule1	21	YZ	Positive	-46 m	0 m	0 m 6.4	0284E-08 N	3.08501E-09 N	1.78814E-0	07 N -447.992 N*m	0.598459 N*m	-1.17254E-06 N*m	6.40284E-08	N 3.08501E-09 N	1 2
StabilityRule2	22	YZ	Positive	-45.8 m	0 m	0 m 6.4	0284E-08 N	3.08501E-09 N	2.08616E-0	07 N -447.992 N*m	0.598457 N*m	-1.90921E-07 N*m	6.40284E-08	N 3.08501E-09 N	1 3
4 🙆 Analyses	23	YZ	Positive	-45.6 m	0 m	0 m 6.4	0284E-08 N	3.08501E-09 N	1.49012E-0	07 N -447.992 N*m	0.598461 N*m	5.50412E-07 N*m	6.40284E-08	N 3.08501E-09 N	1 0
StabilityAnalysis1 O	24	YZ	Positive	-45.4 m	0 m	0 m 6.4	0284E-08 N	3.08501E-09 N	2.08616E-	07 N -447.992 N*m	0.598436 N*m	-7.87899E-07 N*m	6.40284E-08	N 3.08501E-09 N	1 3
	25	YZ	Positive	-45.2 m	0 m	0 m 6.4	0284E-08 N	3.08501E-09 N	1.78814E-0	07 N -447.992 N*m	0.598454 N*m	-7.45989E-07 N*m	6.40284E-08	N 3.08501E-09 N	1 1
StabilityRuleCheck1	26	YZ	Positive	-45 m	0 m	0 m 6.4	0284E-08 N	3.08501E-09 N	2.38419E-	07 N -447.992 N*m	0.598463 N*m	7.54371E-08 N*m	6.40284E-08	N 3.08501E-09 N	4
StrengthAnalysis1	27	YZ	Positive	-44.8 m	0 m	0 m 6.4	0284E-08 N	3.08501E-09 N	1.78814E-	07 N -447.992 N*m	0.598454 N*m	-9.35048E-07 N*m	6.40284E-08	N 3.08501E-09 N	1
📅 MaximumKgAnalysis1	28	YZ	Positive	-44.6 m	0 m	0 m 6.4	0284E-08 N	3.08501E-09 N	1.19209E-0	07 N -447.992 N*m	0.598467 N*m	4.00469E-08 N*m	6.40284E-08	N 3.08501E-09 N	1 3
2 Plots	29	YZ	Positive	-44.4 m	0 m	0 m 6.4	0284E-08 N	3.08501E-09 N	1.78814E-	07 N -447.992 N*m	0.598452 N*m	-1.9595E-06 N*m	6.40284E-08	N 3.08501E-09 N	1 3
Tables	30	YZ	Positive	-44.2 m	0 m	0 m 6.4	0284E-08 N	3.08501E-09 N	1.49012E-0	07 N -447.992 N*m	0.598454 N*m	7.09668E-07 N*m	6.40284E-08	N 3.08501E-09 N	4 2
Pictures	31	YZ	Positive	-44 m	0 m	0 m 6.4	0284E-08 N	3.08501E-09 N	2.08616E-0	07 N -447.992 N*m	0.598436 N*m	7.29226E-07 N*m	6.40284E-08	N 3.08501E-09 N	1 2
Reports	32	YZ	Positive	-43.8 m	0 m	0 m 6.4	0284E-08 N	3.08501E-09 N	1.78814E-	07 N -447.992 N*m	0.598448 N*m	-4.3679E-07 N*m	6.40284E-08	N 3.08501E-09 N	1 2
A Streeports	33	YZ	Positive	-43.6 m	0 m	0 m 6.4	0284E-08 N	3.08501E-09 N	2.08616E-	07 N -447.992 N*m	0.598465 N*m	-3.86499E-07 N*m	6.40284E-08	N 3.08501E-09 N	1 2
	34	YZ	Positive	-43.4 m	0 m	0 m 6.4	0284E-08 N	3.08501E-09 N	1.78814E-0	07 N -447.992 N*m	0.59844 N*m	-8.48435E-07 N*m	6.40284E-08	N 3.08501E-09 N	4 2
-	54														
 Viewsettings ViewSetting1 HydroViewSetting1 	34					m									



- I × Results

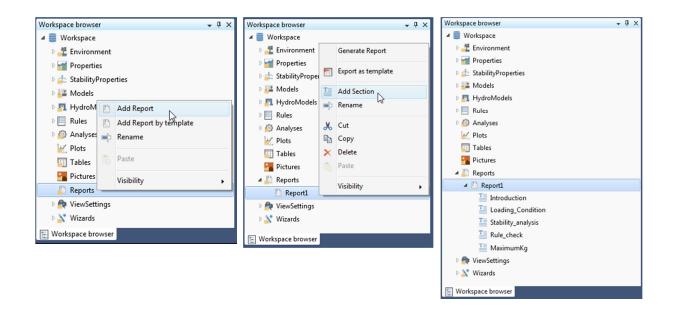
1

Ŵ	MaximumKgAnalysis1											
4	Waterline Z	Z Max KG Critical azimuth		Determining criterion								
1	17.5 m	15.3778 m	0 deg	$Common. Check {\sf Equilibrium Inclination Angle With Wind}$								
2	19.5 m	15.1005 m	0 deg	$Common. Check {\it Equilibrium Inclination Angle With Wind}$								
3	21.5 m	15.4471 m	0 deg	$Common. Check {\sf Equilibrium Inclination Angle With Wind}$								
4	23.5 m	16.1848 m	0 deg	$Common. Check {\it Equilibrium Inclination Angle With Wind}$								
5	25.5 m	17.4109 m	0 deg	$Common. Check {\sf Equilibrium Inclination Angle With Wind}$								
6	27.5 m	18.8592 m	0 deg	Common.CheckEquilibriumInclinationAngleWithWind								

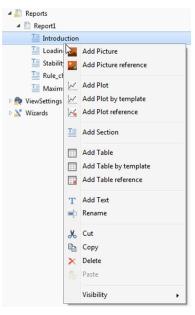
τų×

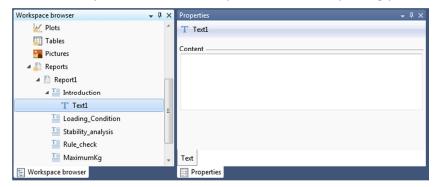
5 CREATE REPORT

A *Report* can be added form the context menu of *Reports* folder in the *Workspace browser*. And several sections can be added to a report. In this tutorial, add five sections as below.



You can add text, picture, plot or table to a Section.





Text could be edited in the *Properties* window and be placed in the corresponding place in the final report.

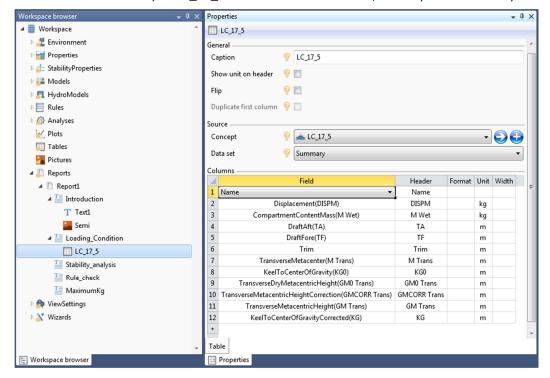
A picture could the screen-shot of the 3D window or an external image file.

Workspace browser 👻 🕂 🗙	Properties 👻 🕂 🗙
🛚 🞒 Analyses 🔷	🔚 Semi
📈 Plots	
III Tables	Source 🤗 💿 From ViewSetting
Pictures	
🔺 🖺 Reports	User specified
🔺 🎦 Report1	Content
▲ Introduction	Picture file 💡
T Text1	Caption 💡
Semi	Size
Loading_Condition	Width 💡 0.24 m
Stability_analysis	Height 💡 0.16 m
Terror Rule_check	
Tel MaximumKg	ViewSettings
🖻 🜪 ViewSettings	ViewSettings 💡 🚔 ViewSetting1 🔹 🕤 🚭
🛚 💦 Wizards	
×	Picture
E Workspace browser	E Properties

A *Table* is added to the section of *Loading_Condition*, with the name *LC_17_5*, and has the settings as below. In the context menu, execute the command of *Generate all columns*. All the columns would be filled to the *Table*.

Workspace browser	- Ū >	Properties		•	Ψ×
🛛 🕌 Models	1	_	_		
 Interpretation Interpretation<td>Generate all co</td><td></td><td>-</td><td><pre></pre></td><td>_</td>	Generate all co		-	<pre></pre>	_
Analyses	Export as temp		neader	₽	
🛄 Tables 🎦 Pictures	📫 Rename		column	♀ □ ♀ □	
 Reports Report1 	🔏 Cut		-		
▲ 🔚 Introduction T Text1	> Delete			Image: Summary	•
Semi 🔤 Loading_Condi		•	der Forr	mat Unit Width	
LC_17_5		+			
Stability_analys	iis				
T Rule_check		, Table			
🔛 Workspace browser		Properties			

All the columns of the summary of *LC_17_5* are listed in the *Columns*, where you could modify further.



Double-click LC_17_5 in Workspace browser, the Table window will open with the table just defined.

Another convenient way to add a *Table* is to use the *Generate table* button in the *Results* window. Switch to the *Results* window of *LC_22_5*, and click *Generate table* button at the top right corner. A *Table* will be generated in the *Tables* folder. Cut the Table and paste it to *Report1* -> *Loading_Condition*.

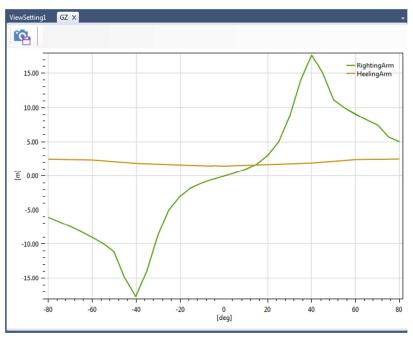
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b to StabilityProperties				2.56511E+07 kg	-11
De Models		Displacement	Y	-	
HydroModels		Displaced volume (beams)	9	0 m^3	
▲ MydroModel1	•	Displacement (beams)	Ŷ	0 kg	
PanelModel1	•	Centre of buoyancy X	9	0 m	
MassModel1 LoadCrossSections1		Centre of buoyancy Y	9	-1.16297E-15 m	
CompartmentModel1	•	Centre of buoyancy Z	0	7.43688 m	=
🖌 📥 LoadingConditions1		LCB	0	0 m	-
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Øpenings1	•	КВ	9	7.43688 m	
HeelingForceModel1		Mass			_
Rules		Total mass	9	2.56511E+07 kg	
Analyses		Centre of gravity X	9	2.37901E-09 m	
V Plots		Centre of gravity Y	9	1.78091E-06 m	
Pictures		Centre of gravity Z	Ŷ	15.6212 m	
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🖻 🚔 ViewSettings		· · · · · · · · · · · · · · · · · · ·	9		
🛚 🌋 Wizards		Results Compartments Part loads	Openings		
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Next, we add a *Plot* to *Stability_analysis* section and rename it to *GZ*. Define the properties of the plot as below, and then execute the command *Generate LineSeries* in the context menu of the plot.

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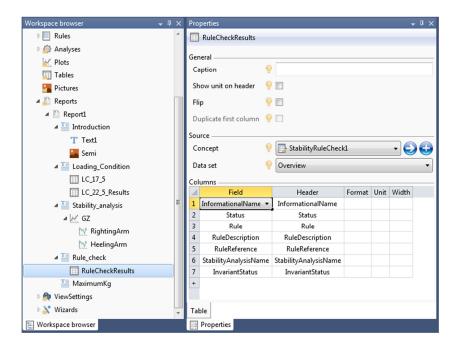
The lines of righting arm and heeling arm are added.

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The MaximumKg		Unit	0 m •
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🔁 Workspace browser		Properties	



Double click *GZ*, the two lines will be shown in the *Plot* window.

We add a *Table* to *Rule_check* section in a way similar to those in *Loading_Condition* section.



In the section of *MaximumKg*, a *Plot* is added to show the maximum KG curve.

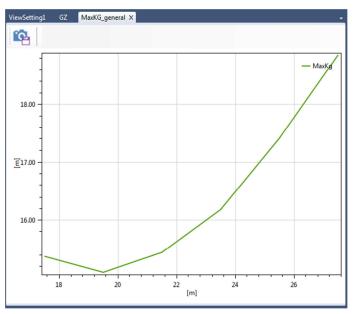
In the context menu, we add a *LineSeries* manually.

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📈 MaxKG_general	-		
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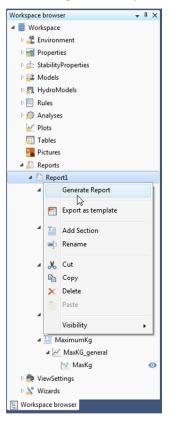
The settings in the *Properties* view are shown as below.

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LC_22_5_Results		Data source X	General results (intact and damaged) ▼
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▲ ₩ MaxKG_general			
📉 MaxKg	*	Data Style	
📔 Workspace browser		Properties	

The curve can be shown in the *Plot* window.



As all the content added, a Word report could be generated by the command Generate Report.



ABOUT DNV GL

Driven by our purpose of safeguarding life, property and the environment, DNV GL enables organizations to advance the safety and sustainability of their business. We provide classification and technical assurance along with software and independent expert advisory services to the maritime, oil and gas, and energy industries. We also provide certification services to customers across a wide range of industries. Operating in more than 100 countries, our 16,000 professionals are dedicated to helping our customers make the world safer, smarter and greener.

SOFTWARE

DNV GL is the world-leading provider of software for a safer, smarter and greener future in the energy, process and maritime industries. Our solutions support a variety of business critical activities including design and engineering, risk assessment, asset integrity and optimization, QHSE, and ship management. Our worldwide presence facilitates a strong customer focus and efficient sharing of industry best practice and standards.