

Application of artificial neural networks to the assessment of stability using the second generation regulation in the early stages of ship design

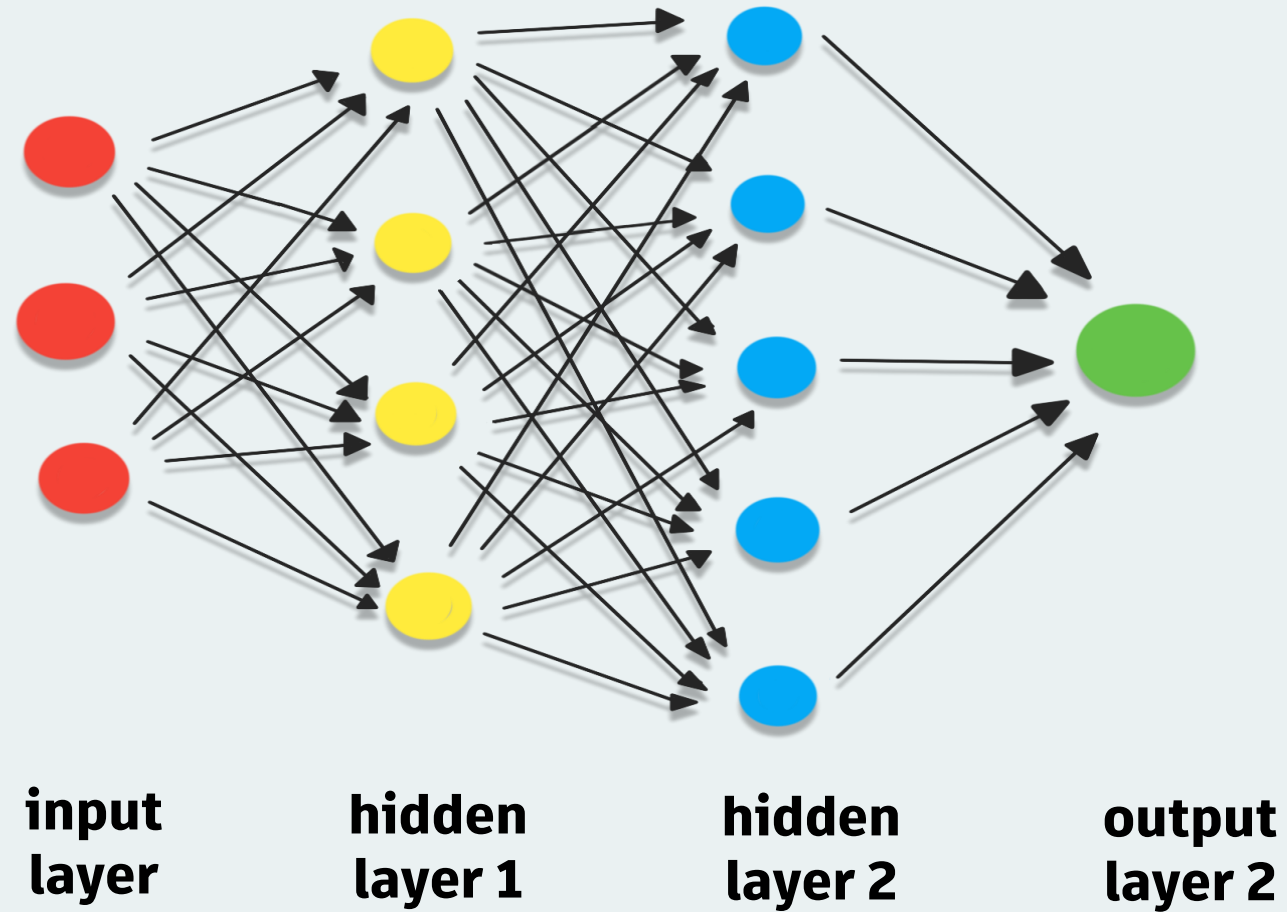
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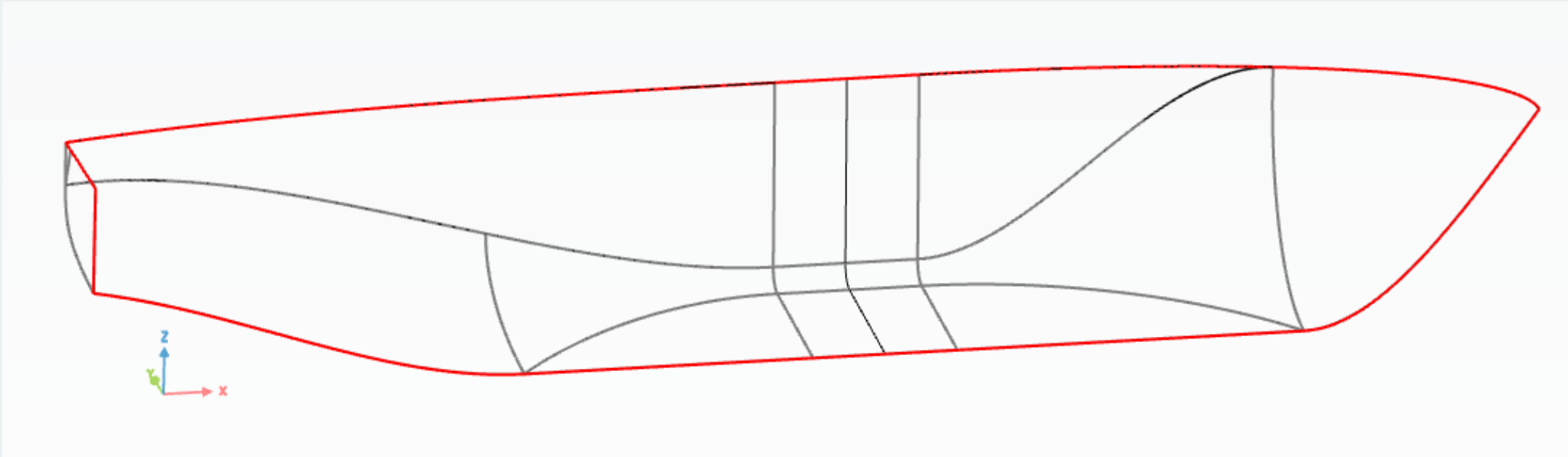
Agenda

- Aim of work
- Parametric model
- Second generation intact stability calculation
- Artificial neural networks
- Results

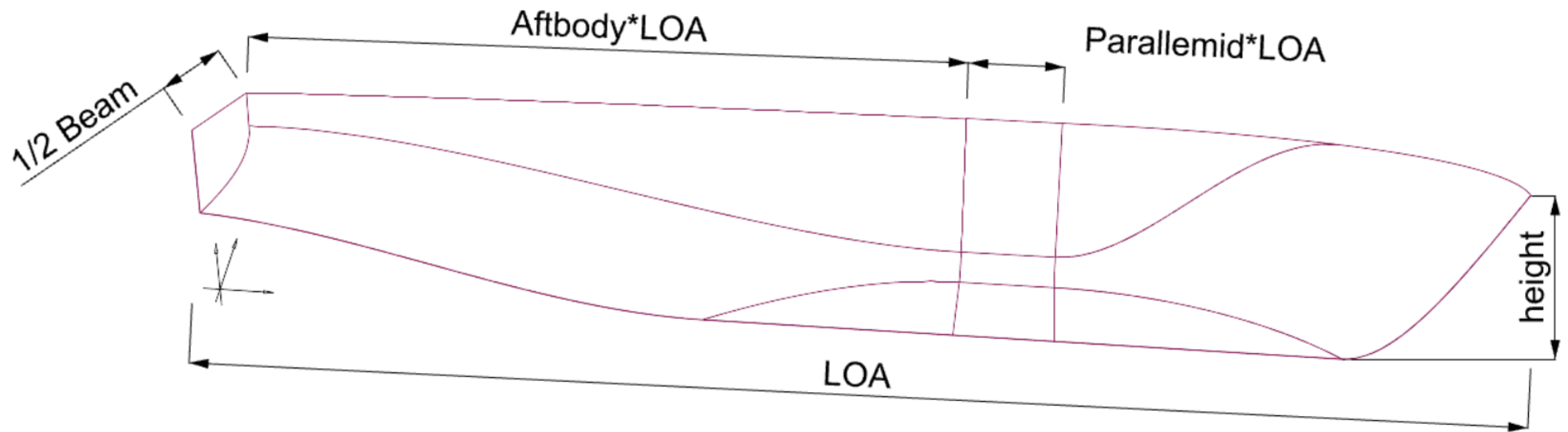
Aim of work



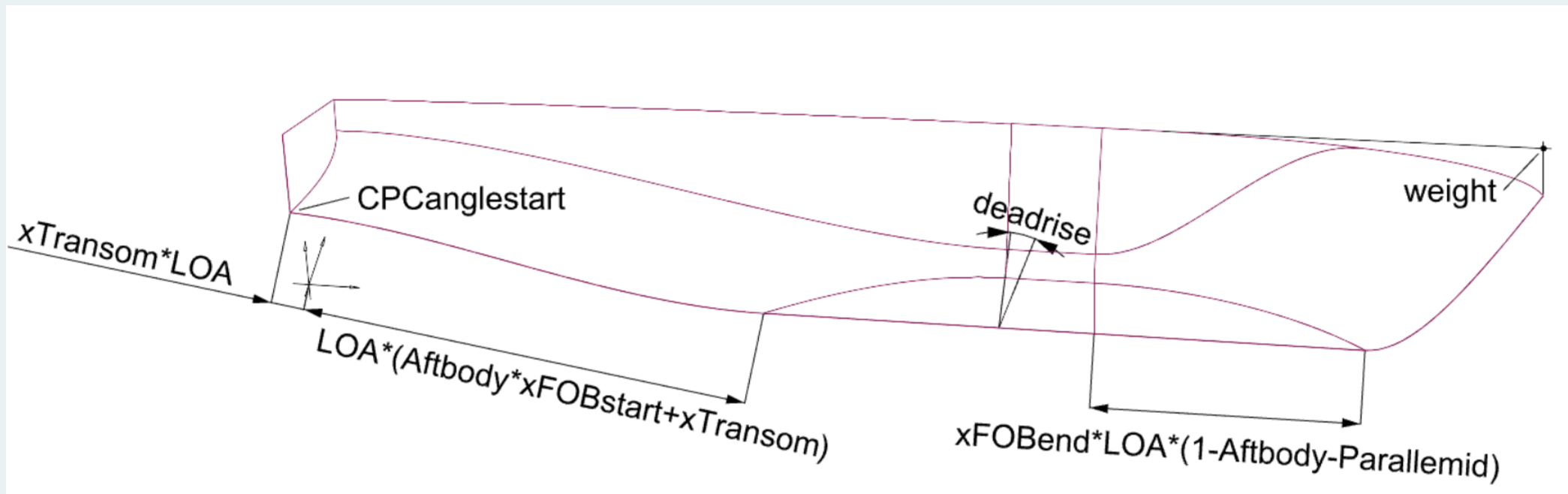
Parametric model



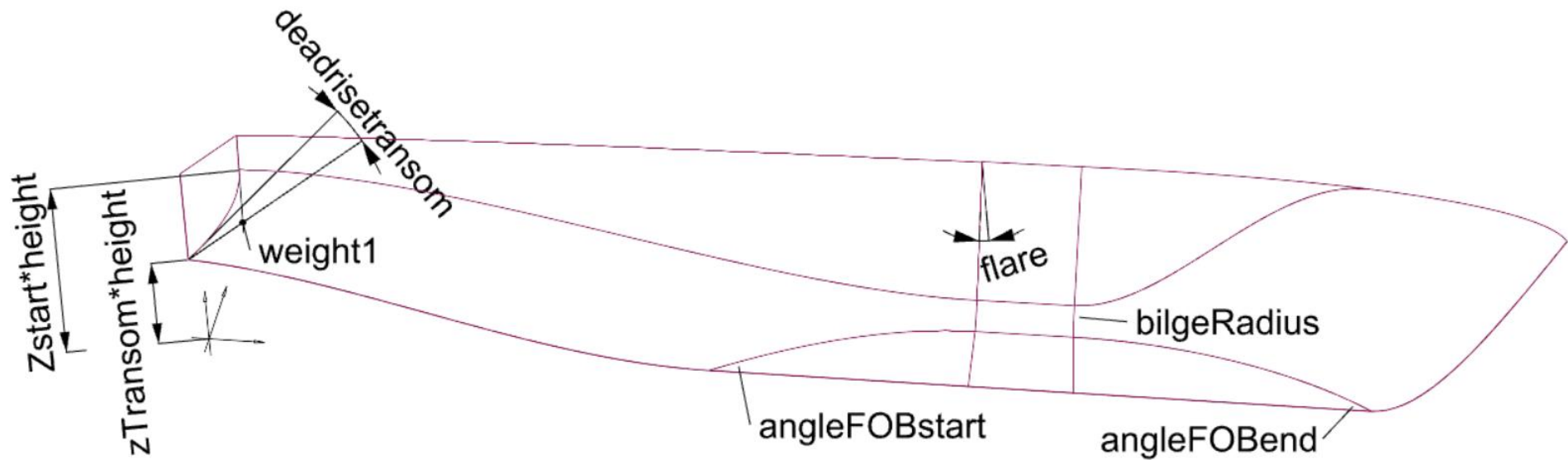
Parametric model



Parametric model



Parametric model



Parameter range

Parameter	Minimum	Maximum
Beam	15	27
Height	7.5	11.5
LOA	80	92
Aftbody	0.4	0.6
Parallelmid	0.0	0.1
Bilgeradius	0.5	2.5
xTransom	-0.1	0.0

Generate and export hulls

FDesignAssembler

designAssembler1

> General

└ Design Pre/Postprocessing

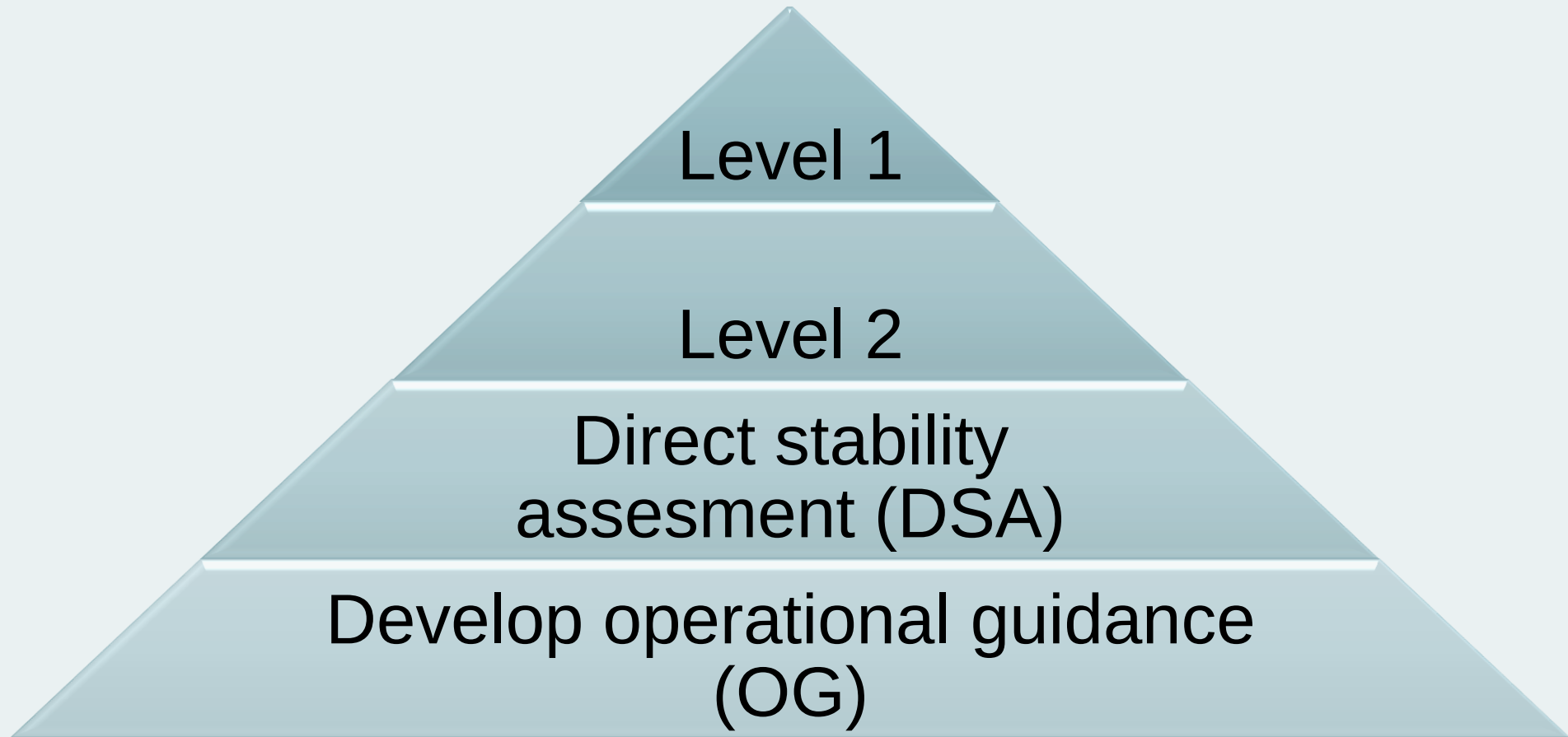
Preprocessing Commands

```
[ |  
hull.exportIG  
ES_deprecate  
d("hull.igs")]
```

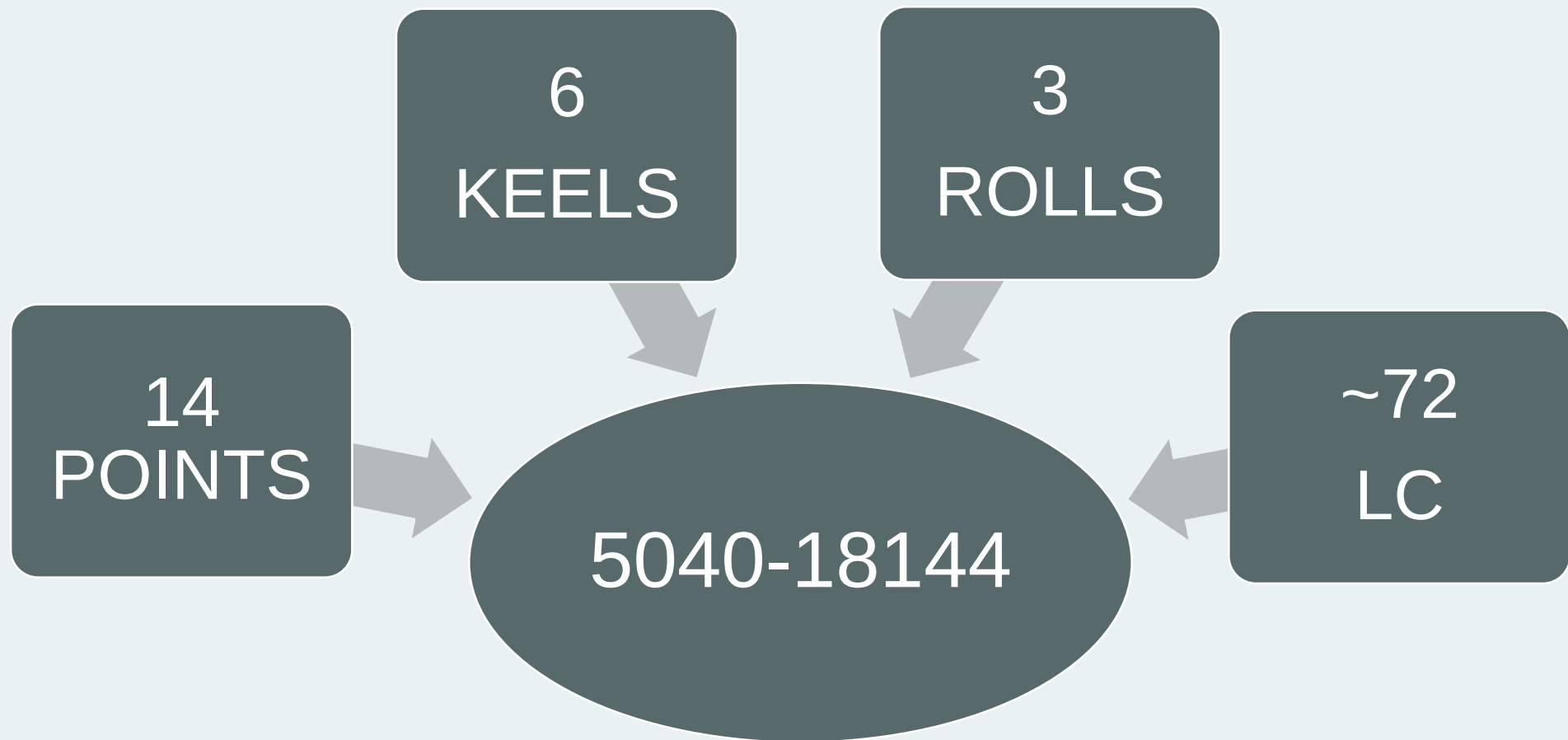
?

	beam	height	LOA
H0001	20.358745	11.25689	83.718363
H0002	19.195015	10.288452	81.147717
H0003	17.668234	7.8223473	87.482384
H0004	25.089044	8.2018852	80.767554
H0005	16.513366	8.4859867	85.235936
H0006	17.012395	9.060386	83.79963

Second Generation Intact Stability (SGIS)



NAPA



SGIS calculation results

LOA	Beam	Height	CB	MKEEL	BKEEL	GM	LCB	T	
80.001417	21.887181	8.719271	0.693483	0	1	0.151000	39.321605	5.826646	1.137461e-11
						0.289973	39.321605	5.826646	3.378292e-08
						0.872637	39.321605	5.826646	1.597238e-06
						1.455302	39.321605	5.826646	1.728208e-05
						2.037967	39.321605	5.826646	8.500087e-05
						2.620631	39.321605	5.826646	2.521811e-04
						3.203296	39.321605	5.826646	5.262969e-04
						3.785960	39.321605	5.826646	8.682377e-04
						4.368625	39.321605	5.826646	1.244365e-03
						4.951290	39.321605	5.826646	1.630893e-03

Name: A, dtype: float64

Artificial neural networks

Model name	input
model.1	LOA, Beam, Height, CB
model.2	LOA, Beam, Height, CB, MKEEL, BKEEL, GM
model.6	LOA, Beam, Height, CB, MKEEL, BKEEL, GM, APOINT, BPOINT, CPOINT, DPOINT, EPOINT, FPOINT, GPOINT, LCB
model.8	LOA, Beam, Height, CB, MKEEL, BKEEL, GM, LCB, T
model.18	LOA, Beam, Height, CB, MKEEL, BKEEL, GM, LCB, P01, P02, P03, P04, P05, P06, P07, P08, P09, P10, P11, P12, P13, P14
model.19	LOA, Beam, Height, CB, MKEEL, BKEEL, GM, LCB, T

Results of artificial neural network models

model name	R^2	threshold	A type
model.6-7	0.6455	0.4	MAX
model.6-18	0.6823	0.74	MEAN
model.8-2	0.6454	0.6	MAX
model.8-9	0.6367	0.75	MEAN

model name	layer1	layer2	layer3	layer4	layer5	layer6	layer7	layer8	layer9
model.6-7	16	32	64	128	128	64	32	16	8
model.6-18	16	32	64	128	128	64	32	16	8
model.8-2	32	64	64	32	16	-	-	-	-
model.8-9	32	64	64	32	16	-	-	-	-

Q&A



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Thank you

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