MEC-E1004 Principles of Naval Architecture

Tips modelling hull surface on Delftship

Aalto University
School of Engineering

Modelling hull surface

Tips before modelling

- There are various techniques and software through which you can model your hull surface.
- Only two techniques are shown in this file.
- This file depend on the hull form excel sheet.
- You can download a free Delftship version through this link: https://download.delftship.net/DSFree.php
- There are some videos to show you how to do it on Delftship

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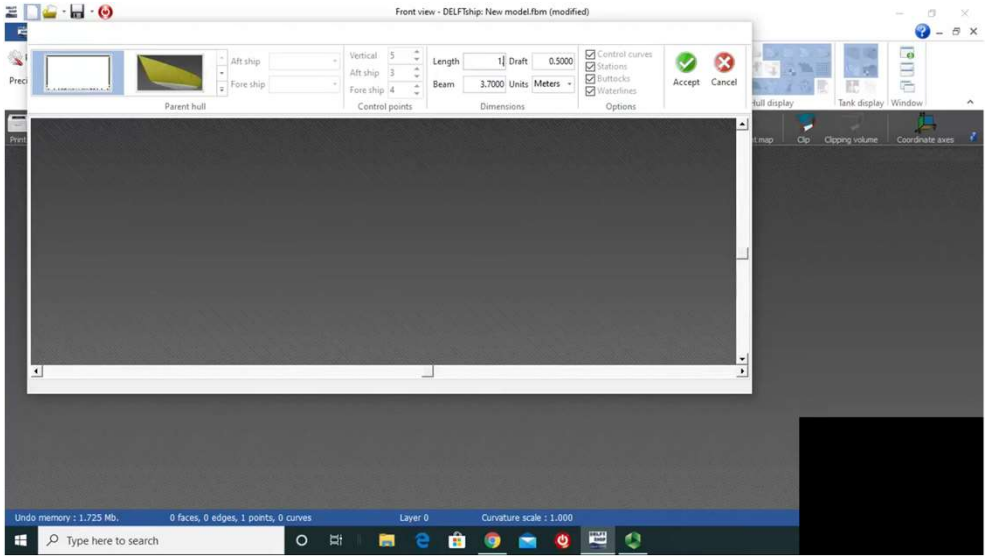
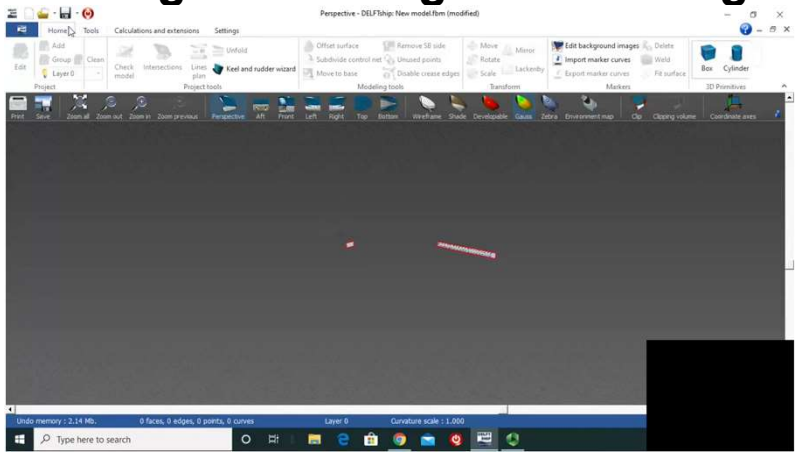
Start new project and insert dimensions

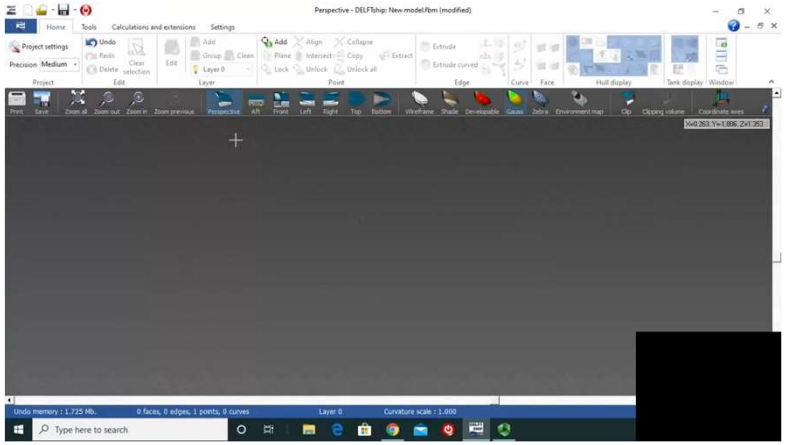
- **Start a new project on Delftship and set your ship dimensions. Noted that the dimensions should be compatible with the background images and then you can scale your model to fit your ship dimensions.**



Insert Background images

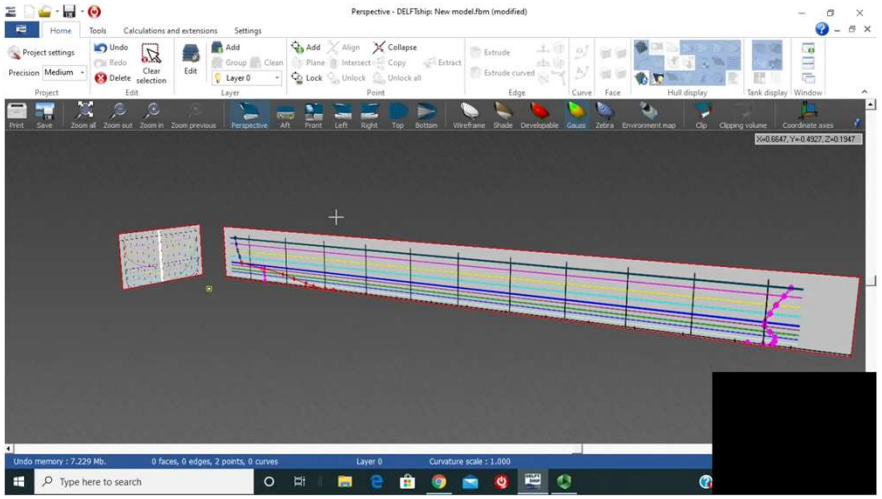
- **Take a screenshot of the profile view and body-plan view from the excel sheet, and save them as JPG or PNG,…**
- **Insert Background images on Delftship and set them to the origin.**
- **Set background images to the origin.**

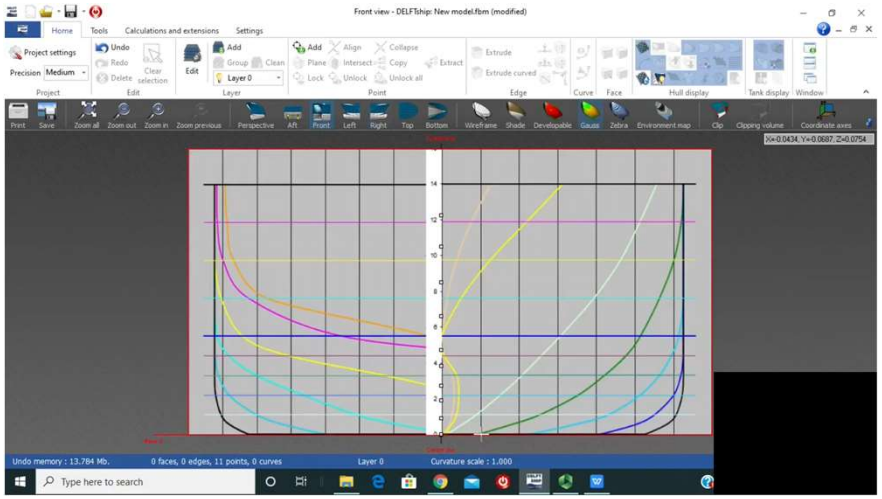




Insert offset points

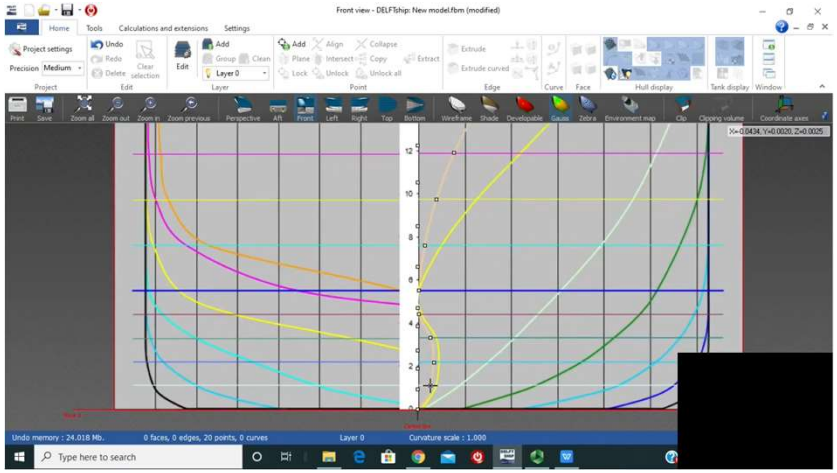
- **Insert the bow lines (make sure all bow markers have zero y-coordinate).**
- **Insert station markers at the zero station.**

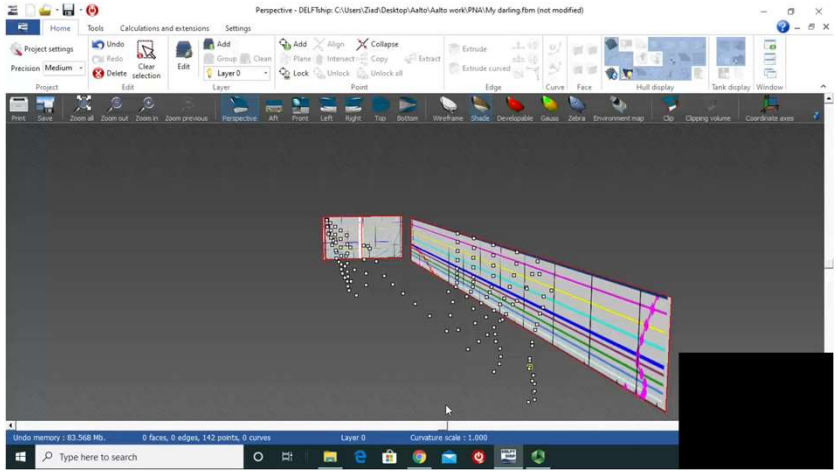




Insert offset points

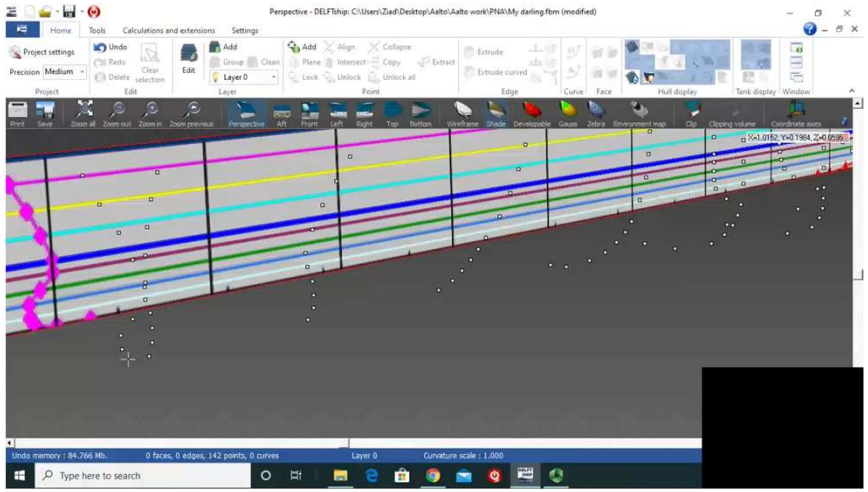
- **Transfer marker points from the zero station to its longitudinal position.**
- **Follow the same procedure to insert stern lines and the rest of the stations for the fore and the aft part of your ship.**

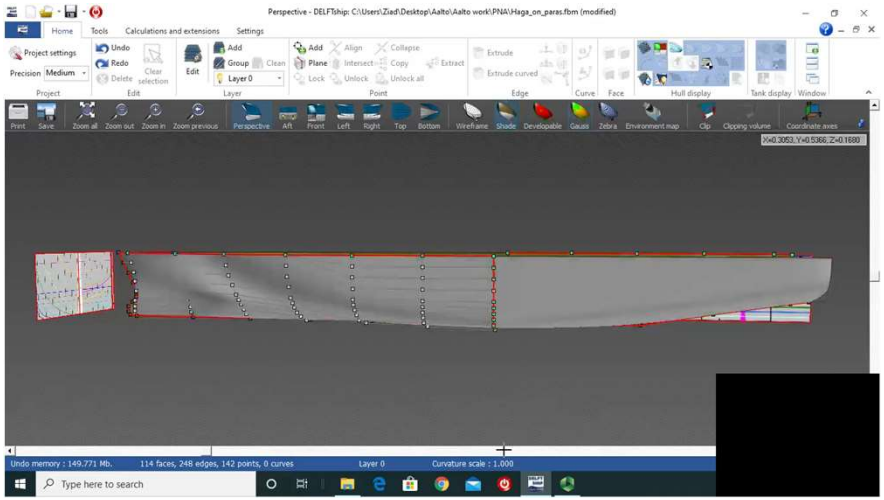




Start model hull surface

- **Use the marker points to model your hull surface.**
- **After modelling there are some options to evaluate your surface such as Gaussian curvature and Zebra option.**





Import markers as text file

Tips before modelling

Instead of importing marker manually you can import a text format from excel sheet.

The text file should be written in the following standards.

It should be an Ascii file with extension .txt.

Import markers as text file

- **The first line contains the number of waterlines.**
- **The second line the number of stations.**
- **The third line indicates whether data describing the deck line at each station is present (1) or not (0).**
- **The fourth line indicates whether data describing the contour line at each station is present (1) or not (0).**

```
11 // Number of waterlines
20 // Number of stations
1 // Read deckline
1 // Read contour
1 // Read aft contour
1 // Read forward contour
0 // Read flat of bottom
12.000 // Length
3.700 // Beam
0.500 // Draft
```

	0.015	0.100	0.200	0.300	0.400	0.600	0.800	1.000	1.200	1.400	1.600			
	5.840	4.117	3.181	2.470	1.883	0.866	0.000	0.000	0.000	0.000	0.000			
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.266	0.850	0.983	1.043	1.069	1.745	1.078	0.784
0.600	0.000	0.000	0.000	0.000	0.000	0.000	0.802	1.039	1.145	1.199	1.223	1.739	1.233	0.655
1.200	0.000	0.000	0.000	0.000	0.000	0.629	1.042	1.208	1.300	1.347	1.370	1.734	1.380	0.531
1.800	0.000	0.000	0.000	0.000	0.000	0.970	1.222	1.359	1.439	1.482	1.504	1.730	1.514	0.415
2.400	0.000	0.000	0.000	0.000	0.767	1.175	1.369	1.487	1.558	1.597	1.618	1.728	1.628	0.311
3.000	0.000	0.000	0.000	0.750	1.032	1.322	1.484	1.587	1.650	1.686	1.708	1.726	1.718	0.222
3.600	0.000	0.000	0.637	0.998	1.194	1.427	1.567	1.658	1.714	1.749	1.770	1.727	1.781	0.150
4.200	0.000	0.196	0.896	1.141	1.299	1.497	1.620	1.701	1.753	1.785	1.807	1.730	1.818	0.092
4.800	0.000	0.656	1.026	1.225	1.361	1.535	1.644	1.717	1.765	1.797	1.818	1.735	1.830	0.050
5.400	0.000	0.797	1.087	1.261	1.382	1.540	1.640	1.708	1.753	1.784	1.806	1.743	1.819	0.023
6.000	0.073	0.833	1.091	1.251	1.364	1.512	1.607	1.671	1.715	1.746	1.768	1.754	1.783	0.013
6.600	0.000	0.784	1.038	1.193	1.303	1.448	1.541	1.604	1.649	1.681	1.704	1.767	1.721	0.018
7.200	0.000	0.643	0.924	1.084	1.197	1.345	1.439	1.505	1.552	1.586	1.612	1.783	1.632	0.037
7.800	0.000	0.349	0.746	0.922	1.042	1.200	1.300	1.370	1.422	1.460	1.490	1.801	1.515	0.069
8.400	0.000	0.000	0.491	0.714	0.844	1.014	1.123	1.201	1.259	1.303	1.338	1.820	1.370	0.113
9.000	0.000	0.000	0.150	0.462	0.614	0.797	0.914	0.999	1.065	1.116	1.157	1.840	1.199	0.168
9.600	0.000	0.000	0.000	0.175	0.365	0.559	0.680	0.770	0.842	0.901	0.950	1.862	1.003	0.235
10.200	0.000	0.000	0.000	0.000	0.119	0.314	0.431	0.520	0.595	0.660	0.715	1.884	0.783	0.320
10.800	0.000	0.000	0.000	0.000	0.000	0.088	0.177	0.256	0.329	0.396	0.457	1.908	0.539	0.442
11.400	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.053	0.116	0.178	1.932	0.275	1.021
	6.371	8.247	9.305	10.081	10.632	11.112	11.254	11.386	11.516	11.645	11.773			

Import markers as text file

- **The fifth line indicates whether data describing the aft contour at each waterline is present (1) or not (0).**
- **The sixth line indicates whether data describing the forward contour at each waterline is present (1) or not (0).**
- **The seventh line indicates whether data describing the flat of bottom at each station is present (1) or not (0).**
- **The next three lines describe the length, beam and draft of the ship as used in the project settings respectively.**

```
11 // Number of waterlines
20 // Number of stations
1 // Read deckline
1 // Read contour
1 // Read aft contour
1 // Read forward contour
0 // Read flat of bottom
12.000 // Length
3.700 // Beam
0.500 // Draft
```

	0.015	0.100	0.200	0.300	0.400	0.600	0.800	1.000	1.200	1.400	1.600			
	5.840	4.117	3.181	2.470	1.883	0.866	0.000	0.000	0.000	0.000	0.000			
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.266	0.850	0.983	1.043	1.069	1.745	1.078	0.784
0.600	0.000	0.000	0.000	0.000	0.000	0.000	0.802	1.039	1.145	1.199	1.223	1.739	1.233	0.655
1.200	0.000	0.000	0.000	0.000	0.000	0.629	1.042	1.208	1.300	1.347	1.370	1.734	1.380	0.531
1.800	0.000	0.000	0.000	0.000	0.000	0.970	1.222	1.359	1.439	1.482	1.504	1.730	1.514	0.415
2.400	0.000	0.000	0.000	0.000	0.767	1.175	1.369	1.487	1.558	1.597	1.618	1.728	1.628	0.311
3.000	0.000	0.000	0.000	0.750	1.032	1.322	1.484	1.587	1.650	1.686	1.708	1.726	1.718	0.222
3.600	0.000	0.000	0.637	0.998	1.194	1.427	1.567	1.658	1.714	1.749	1.770	1.727	1.781	0.150
4.200	0.000	0.196	0.896	1.141	1.299	1.497	1.620	1.701	1.753	1.785	1.807	1.730	1.818	0.092
4.800	0.000	0.656	1.026	1.225	1.361	1.535	1.644	1.717	1.765	1.797	1.818	1.735	1.830	0.050
5.400	0.000	0.797	1.087	1.261	1.382	1.540	1.640	1.708	1.753	1.784	1.806	1.743	1.819	0.023
6.000	0.073	0.833	1.091	1.251	1.364	1.512	1.607	1.671	1.715	1.746	1.768	1.754	1.783	0.013
6.600	0.000	0.784	1.038	1.193	1.303	1.448	1.541	1.604	1.649	1.681	1.704	1.767	1.721	0.018
7.200	0.000	0.643	0.924	1.084	1.197	1.345	1.439	1.505	1.552	1.586	1.612	1.783	1.632	0.037
7.800	0.000	0.349	0.746	0.922	1.042	1.200	1.300	1.370	1.422	1.460	1.490	1.801	1.515	0.069
8.400	0.000	0.000	0.491	0.714	0.844	1.014	1.123	1.201	1.259	1.303	1.338	1.820	1.370	0.113
9.000	0.000	0.000	0.150	0.462	0.614	0.797	0.914	0.999	1.065	1.116	1.157	1.840	1.199	0.168
9.600	0.000	0.000	0.000	0.175	0.365	0.559	0.680	0.770	0.842	0.901	0.950	1.862	1.003	0.235
10.200	0.000	0.000	0.000	0.000	0.119	0.314	0.431	0.520	0.595	0.660	0.715	1.884	0.783	0.320
10.800	0.000	0.000	0.000	0.000	0.000	0.088	0.177	0.256	0.329	0.396	0.457	1.908	0.539	0.442
11.400	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.053	0.116	0.178	1.932	0.275	1.021
	6.371	8.247	9.305	10.081	10.632	11.112	11.254	11.386	11.516	11.645	11.773			

Import markers as text file

- **The first row represents the heights of each of the waterlines.**
- **The second row represents the distance of aft contour points to each waterline.**

```
11 // Number of waterlines
20 // Number of stations
1 // Read deckline
1 // Read contour
1 // Read aft contour
1 // Read forward contour
0 // Read flat of bottom
12.000 // Length
3.700 // Beam
0.500 // Draft
          0.015   0.100   0.200   0.300   0.400   0.600   0.800   1.000   1.200   1.400   1.600
          5.840   4.117   3.181   2.470   1.883   0.866   0.000   0.000   0.000   0.000   0.000
0.000     0.000   0.000   0.000   0.000   0.000   0.000   0.266   0.850   0.983   1.043   1.069   1.745   1.078   0.784
0.600     0.000   0.000   0.000   0.000   0.000   0.000   0.802   1.039   1.145   1.199   1.223   1.739   1.233   0.655
1.200     0.000   0.000   0.000   0.000   0.000   0.629   1.042   1.208   1.300   1.347   1.370   1.734   1.380   0.531
1.800     0.000   0.000   0.000   0.000   0.000   0.970   1.222   1.359   1.439   1.482   1.504   1.730   1.514   0.415
2.400     0.000   0.000   0.000   0.000   0.767   1.175   1.369   1.487   1.558   1.597   1.618   1.728   1.628   0.311
3.000     0.000   0.000   0.000   0.750   1.032   1.322   1.484   1.587   1.650   1.686   1.708   1.726   1.718   0.222
3.600     0.000   0.000   0.637   0.998   1.194   1.427   1.567   1.658   1.714   1.749   1.770   1.727   1.781   0.150
4.200     0.000   0.196   0.896   1.141   1.299   1.497   1.620   1.701   1.753   1.785   1.807   1.730   1.818   0.092
4.800     0.000   0.656   1.026   1.225   1.361   1.535   1.644   1.717   1.765   1.797   1.818   1.735   1.830   0.050
5.400     0.000   0.797   1.087   1.261   1.382   1.540   1.640   1.708   1.753   1.784   1.806   1.743   1.819   0.023
6.000     0.073   0.833   1.091   1.251   1.364   1.512   1.607   1.671   1.715   1.746   1.768   1.754   1.783   0.013
6.600     0.000   0.784   1.038   1.193   1.303   1.448   1.541   1.604   1.649   1.681   1.704   1.767   1.721   0.018
7.200     0.000   0.643   0.924   1.084   1.197   1.345   1.439   1.505   1.552   1.586   1.612   1.783   1.632   0.037
7.800     0.000   0.349   0.746   0.922   1.042   1.200   1.300   1.370   1.422   1.460   1.490   1.801   1.515   0.069
8.400     0.000   0.000   0.491   0.714   0.844   1.014   1.123   1.201   1.259   1.303   1.338   1.820   1.370   0.113
9.000     0.000   0.000   0.150   0.462   0.614   0.797   0.914   0.999   1.065   1.116   1.157   1.840   1.199   0.168
9.600     0.000   0.000   0.000   0.175   0.365   0.559   0.680   0.770   0.842   0.901   0.950   1.862   1.003   0.235
10.200    0.000   0.000   0.000   0.000   0.119   0.314   0.431   0.520   0.595   0.660   0.715   1.884   0.783   0.320
10.800    0.000   0.000   0.000   0.000   0.000   0.088   0.177   0.256   0.329   0.396   0.457   1.908   0.539   0.442
11.400    0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.053   0.116   0.178   1.932   0.275   1.021
          6.371   8.247   9.305  10.081  10.632  11.112  11.254  11.386  11.516  11.645  11.773
```


```
11 // Number of waterlines
20 // Number of stations
1 // Read deckline
1 // Read contour
1 // Read aft contour
1 // Read forward contour
0 // Read flat of bottom
12.000 // Length
3.700 // Beam
0.500 // Draft
          0.015   0.100   0.200   0.300   0.400   0.600   0.800   1.000   1.200   1.400   1.600
          5.840   4.117   3.181   2.470   1.883   0.866   0.000   0.000   0.000   0.000   0.000
0.000     0.000   0.000   0.000   0.000   0.000   0.000   0.266   0.850   0.983   1.043   1.069   1.745   1.078   0.784
0.600     0.000   0.000   0.000   0.000   0.000   0.000   0.802   1.039   1.145   1.199   1.223   1.739   1.233   0.655
1.200     0.000   0.000   0.000   0.000   0.000   0.629   1.042   1.208   1.300   1.347   1.370   1.734   1.380   0.531
1.800     0.000   0.000   0.000   0.000   0.000   0.970   1.222   1.359   1.439   1.482   1.504   1.730   1.514   0.415
2.400     0.000   0.000   0.000   0.000   0.767   1.175   1.369   1.487   1.558   1.597   1.618   1.728   1.628   0.311
3.000     0.000   0.000   0.000   0.750   1.032   1.322   1.484   1.587   1.650   1.686   1.708   1.726   1.718   0.222
3.600     0.000   0.000   0.637   0.998   1.194   1.427   1.567   1.658   1.714   1.749   1.770   1.727   1.781   0.150
4.200     0.000   0.196   0.896   1.141   1.299   1.497   1.620   1.701   1.753   1.785   1.807   1.730   1.818   0.092
4.800     0.000   0.656   1.026   1.225   1.361   1.535   1.644   1.717   1.765   1.797   1.818   1.735   1.830   0.050
5.400     0.000   0.797   1.087   1.261   1.382   1.540   1.640   1.708   1.753   1.784   1.806   1.743   1.819   0.023
6.000     0.073   0.833   1.091   1.251   1.364   1.512   1.607   1.671   1.715   1.746   1.768   1.754   1.783   0.013
6.600     0.000   0.784   1.038   1.193   1.303   1.448   1.541   1.604   1.649   1.681   1.704   1.767   1.721   0.018
7.200     0.000   0.643   0.924   1.084   1.197   1.345   1.439   1.505   1.552   1.586   1.612   1.783   1.632   0.037
7.800     0.000   0.349   0.746   0.922   1.042   1.200   1.300   1.370   1.422   1.460   1.490   1.801   1.515   0.069
8.400     0.000   0.000   0.491   0.714   0.844   1.014   1.123   1.201   1.259   1.303   1.338   1.820   1.370   0.113
9.000     0.000   0.000   0.150   0.462   0.614   0.797   0.914   0.999   1.065   1.116   1.157   1.840   1.199   0.168
9.600     0.000   0.000   0.000   0.175   0.365   0.559   0.680   0.770   0.842   0.901   0.950   1.862   1.003   0.235
10.200    0.000   0.000   0.000   0.000   0.119   0.314   0.431   0.520   0.595   0.660   0.715   1.884   0.783   0.320
10.800    0.000   0.000   0.000   0.000   0.000   0.088   0.177   0.256   0.329   0.396   0.457   1.908   0.539   0.442
11.400    0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.053   0.116   0.178   1.932   0.275   1.021
          6.371   8.247   9.305  10.081  10.632  11.112  11.254  11.386  11.516  11.645  11.773
```

Import markers as text file

- **The right column represents distance of each of stations from the reference point (AP commonly).**
- **The inside table is the offset data.**

```
11 // Number of waterlines
20 // Number of stations
1 // Read deckline
1 // Read contour
1 // Read aft contour
1 // Read forward contour
0 // Read flat of bottom
12.000 // Length
3.700 // Beam
0.500 // Draft
        0.015   0.100   0.200   0.300   0.400   0.600   0.800   1.000   1.200   1.400   1.600
        5.840   4.117   3.181   2.470   1.883   0.866   0.000   0.000   0.000   0.000   0.000
0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.266   0.850   0.983   1.043   1.069   1.745   1.078   0.784
0.600   0.000   0.000   0.000   0.000   0.000   0.000   0.802   1.039   1.145   1.199   1.223   1.739   1.233   0.655
1.200   0.000   0.000   0.000   0.000   0.000   0.629   1.042   1.208   1.300   1.347   1.370   1.734   1.380   0.531
1.800   0.000   0.000   0.000   0.000   0.000   0.970   1.222   1.359   1.439   1.482   1.504   1.730   1.514   0.415
2.400   0.000   0.000   0.000   0.000   0.767   1.175   1.369   1.487   1.558   1.597   1.618   1.728   1.628   0.311
3.000   0.000   0.000   0.000   0.750   1.032   1.322   1.484   1.587   1.650   1.686   1.708   1.726   1.718   0.222
3.600   0.000   0.000   0.637   0.998   1.194   1.427   1.567   1.658   1.714   1.749   1.770   1.727   1.781   0.150
4.200   0.000   0.196   0.896   1.141   1.299   1.497   1.620   1.701   1.753   1.785   1.807   1.730   1.818   0.092
4.800   0.000   0.656   1.026   1.225   1.361   1.535   1.644   1.717   1.765   1.797   1.818   1.735   1.830   0.050
5.400   0.000   0.797   1.087   1.261   1.382   1.540   1.640   1.708   1.753   1.784   1.806   1.743   1.819   0.023
6.000   0.073   0.833   1.091   1.251   1.364   1.512   1.607   1.671   1.715   1.746   1.768   1.754   1.783   0.013
6.600   0.000   0.784   1.038   1.193   1.303   1.448   1.541   1.604   1.649   1.681   1.704   1.767   1.721   0.018
7.200   0.000   0.643   0.924   1.084   1.197   1.345   1.439   1.505   1.552   1.586   1.612   1.783   1.632   0.037
7.800   0.000   0.349   0.746   0.922   1.042   1.200   1.300   1.370   1.422   1.460   1.490   1.801   1.515   0.069
8.400   0.000   0.000   0.491   0.714   0.844   1.014   1.123   1.201   1.259   1.303   1.338   1.820   1.370   0.113
9.000   0.000   0.000   0.150   0.462   0.614   0.797   0.914   0.999   1.065   1.116   1.157   1.840   1.199   0.168
9.600   0.000   0.000   0.000   0.175   0.365   0.559   0.680   0.770   0.842   0.901   0.950   1.862   1.003   0.235
10.200  0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.053   0.116   0.178   1.932   0.275   1.021
10.800  0.000   0.000   0.000   0.000   0.000   0.088   0.177   0.256   0.329   0.396   0.457   1.908   0.539   0.442
11.400  0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.053   0.116   0.178   1.932   0.275   1.021
        6.371   8.247   9.305   10.081  10.632  11.112  11.254  11.386  11.516  11.645  11.773
```


```
11 // Number of waterlines
20 // Number of stations
1 // Read deckline
1 // Read contour
1 // Read aft contour
1 // Read forward contour
0 // Read flat of bottom
12.000 // Length
3.700 // Beam
0.500 // Draft
        0.015   0.100   0.200   0.300   0.400   0.600   0.800   1.000   1.200   1.400   1.600
        5.840   4.117   3.181   2.470   1.883   0.866   0.000   0.000   0.000   0.000   0.000
0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.266   0.850   0.983   1.043   1.069   1.745   1.078   0.784
0.600   0.000   0.000   0.000   0.000   0.000   0.000   0.802   1.039   1.145   1.199   1.223   1.739   1.233   0.655
1.200   0.000   0.000   0.000   0.000   0.000   0.629   1.042   1.208   1.300   1.347   1.370   1.734   1.380   0.531
1.800   0.000   0.000   0.000   0.000   0.000   0.970   1.222   1.359   1.439   1.482   1.504   1.730   1.514   0.415
2.400   0.000   0.000   0.000   0.000   0.767   1.175   1.369   1.487   1.558   1.597   1.618   1.728   1.628   0.311
3.000   0.000   0.000   0.000   0.750   1.032   1.322   1.484   1.587   1.650   1.686   1.708   1.726   1.718   0.222
3.600   0.000   0.000   0.637   0.998   1.194   1.427   1.567   1.658   1.714   1.749   1.770   1.727   1.781   0.150
4.200   0.000   0.196   0.896   1.141   1.299   1.497   1.620   1.701   1.753   1.785   1.807   1.730   1.818   0.092
4.800   0.000   0.656   1.026   1.225   1.361   1.535   1.644   1.717   1.765   1.797   1.818   1.735   1.830   0.050
5.400   0.000   0.797   1.087   1.261   1.382   1.540   1.640   1.708   1.753   1.784   1.806   1.743   1.819   0.023
6.000   0.073   0.833   1.091   1.251   1.364   1.512   1.607   1.671   1.715   1.746   1.768   1.754   1.783   0.013
6.600   0.000   0.784   1.038   1.193   1.303   1.448   1.541   1.604   1.649   1.681   1.704   1.767   1.721   0.018
7.200   0.000   0.643   0.924   1.084   1.197   1.345   1.439   1.505   1.552   1.586   1.612   1.783   1.632   0.037
7.800   0.000   0.349   0.746   0.922   1.042   1.200   1.300   1.370   1.422   1.460   1.490   1.801   1.515   0.069
8.400   0.000   0.000   0.491   0.714   0.844   1.014   1.123   1.201   1.259   1.303   1.338   1.820   1.370   0.113
9.000   0.000   0.000   0.150   0.462   0.614   0.797   0.914   0.999   1.065   1.116   1.157   1.840   1.199   0.168
9.600   0.000   0.000   0.000   0.175   0.365   0.559   0.680   0.770   0.842   0.901   0.950   1.862   1.003   0.235
10.200  0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.053   0.116   0.178   1.932   0.275   1.021
10.800  0.000   0.000   0.000   0.000   0.000   0.088   0.177   0.256   0.329   0.396   0.457   1.908   0.539   0.442
11.400  0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.053   0.116   0.178   1.932   0.275   1.021
        6.371   8.247   9.305   10.081  10.632  11.112  11.254  11.386  11.516  11.645  11.773
```

Import markers as text file

- **The left and the right column represent the height and the beam of the deck line at each station.**
- **The rightest column represents the contour line heights at each station.**
- **The last row represents the distance of bow contour line to each waterline.**

```
11 // Number of waterlines
20 // Number of stations
1 // Read deckline
1 // Read contour
1 // Read aft contour
1 // Read forward contour
0 // Read flat of bottom
12.000 // Length
3.700 // Beam
0.500 // Draft
        0.015   0.100   0.200   0.300   0.400   0.600   0.800   1.000   1.200   1.400   1.600
        5.840   4.117   3.181   2.470   1.883   0.866   0.000   0.000   0.000   0.000   0.000
0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.266   0.850   0.983   1.069   1.745   1.078   0.784
0.600   0.000   0.000   0.000   0.000   0.000   0.000   0.802   1.039   1.145   1.199   1.223   1.739   1.233   0.655
1.200   0.000   0.000   0.000   0.000   0.000   0.629   1.042   1.208   1.300   1.347   1.370   1.734   1.380   0.531
1.800   0.000   0.000   0.000   0.000   0.000   0.970   1.222   1.359   1.439   1.482   1.504   1.730   1.514   0.415
2.400   0.000   0.000   0.000   0.000   0.767   1.175   1.369   1.487   1.558   1.597   1.618   1.728   1.628   0.311
3.000   0.000   0.000   0.000   0.750   1.032   1.322   1.484   1.587   1.650   1.686   1.708   1.726   1.718   0.222
3.600   0.000   0.000   0.637   0.998   1.194   1.427   1.567   1.658   1.714   1.749   1.770   1.727   1.781   0.150
4.200   0.000   0.196   0.896   1.141   1.299   1.497   1.620   1.701   1.753   1.785   1.807   1.730   1.818   0.092
4.800   0.000   0.656   1.026   1.225   1.361   1.535   1.644   1.717   1.765   1.797   1.818   1.735   1.830   0.050
5.400   0.000   0.797   1.087   1.261   1.382   1.540   1.640   1.708   1.753   1.784   1.806   1.743   1.819   0.023
6.000   0.073   0.833   1.091   1.251   1.364   1.512   1.607   1.671   1.715   1.746   1.768   1.754   1.783   0.013
6.600   0.000   0.784   1.038   1.193   1.303   1.448   1.541   1.604   1.649   1.681   1.704   1.767   1.721   0.018
7.200   0.000   0.643   0.924   1.084   1.197   1.345   1.439   1.505   1.552   1.586   1.612   1.783   1.632   0.037
7.800   0.000   0.349   0.746   0.922   1.042   1.200   1.300   1.370   1.422   1.460   1.490   1.801   1.515   0.069
8.400   0.000   0.000   0.491   0.714   0.844   1.014   1.123   1.201   1.259   1.303   1.338   1.820   1.370   0.113
9.000   0.000   0.000   0.150   0.462   0.614   0.797   0.914   0.999   1.065   1.116   1.157   1.840   1.199   0.168
9.600   0.000   0.000   0.000   0.175   0.365   0.559   0.680   0.770   0.842   0.901   0.950   1.862   1.003   0.235
10.200  0.000   0.000   0.000   0.000   0.119   0.314   0.431   0.520   0.595   0.660   0.715   1.884   0.783   0.320
10.800  0.000   0.000   0.000   0.000   0.000   0.000   0.088   0.177   0.256   0.329   0.396   0.457   1.908   0.539   0.442
11.400  0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.053   0.116   0.178   1.932   0.275   1.021
        6.371   8.247   9.305   10.081  10.632  11.112  11.254  11.386  11.516  11.645  11.773
```


```
11 // Number of waterlines
20 // Number of stations
1 // Read deckline
1 // Read contour
1 // Read aft contour
1 // Read forward contour
0 // Read flat of bottom
12.000 // Length
3.700 // Beam
0.500 // Draft
        0.015   0.100   0.200   0.300   0.400   0.600   0.800   1.000   1.200   1.400   1.600
        5.840   4.117   3.181   2.470   1.883   0.866   0.000   0.000   0.000   0.000   0.000
0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.266   0.850   0.983   1.043   1.069   1.745   1.078   0.784
0.600   0.000   0.000   0.000   0.000   0.000   0.000   0.802   1.039   1.145   1.199   1.223   1.739   1.233   0.655
1.200   0.000   0.000   0.000   0.000   0.000   0.629   1.042   1.208   1.300   1.347   1.370   1.734   1.380   0.531
1.800   0.000   0.000   0.000   0.000   0.000   0.970   1.222   1.359   1.439   1.482   1.504   1.730   1.514   0.415
2.400   0.000   0.000   0.000   0.000   0.767   1.175   1.369   1.487   1.558   1.597   1.618   1.728   1.628   0.311
3.000   0.000   0.000   0.000   0.750   1.032   1.322   1.484   1.587   1.650   1.686   1.708   1.726   1.718   0.222
3.600   0.000   0.000   0.637   0.998   1.194   1.427   1.567   1.658   1.714   1.749   1.770   1.727   1.781   0.150
4.200   0.000   0.196   0.896   1.141   1.299   1.497   1.620   1.701   1.753   1.785   1.807   1.730   1.818   0.092
4.800   0.000   0.656   1.026   1.225   1.361   1.535   1.644   1.717   1.765   1.797   1.818   1.735   1.830   0.050
5.400   0.000   0.797   1.087   1.261   1.382   1.540   1.640   1.708   1.753   1.784   1.806   1.743   1.819   0.023
6.000   0.073   0.833   1.091   1.251   1.364   1.512   1.607   1.671   1.715   1.746   1.768   1.754   1.783   0.013
6.600   0.000   0.784   1.038   1.193   1.303   1.448   1.541   1.604   1.649   1.681   1.704   1.767   1.721   0.018
7.200   0.000   0.643   0.924   1.084   1.197   1.345   1.439   1.505   1.552   1.586   1.612   1.783   1.632   0.037
7.800   0.000   0.349   0.746   0.922   1.042   1.200   1.300   1.370   1.422   1.460   1.490   1.801   1.515   0.069
8.400   0.000   0.000   0.491   0.714   0.844   1.014   1.123   1.201   1.259   1.303   1.338   1.820   1.370   0.113
9.000   0.000   0.000   0.150   0.462   0.614   0.797   0.914   0.999   1.065   1.116   1.157   1.840   1.199   0.168
9.600   0.000   0.000   0.000   0.175   0.365   0.559   0.680   0.770   0.842   0.901   0.950   1.862   1.003   0.235
10.200  0.000   0.000   0.000   0.000   0.119   0.314   0.431   0.520   0.595   0.660   0.715   1.884   0.783   0.320
10.800  0.000   0.000   0.000   0.000   0.000   0.000   0.088   0.177   0.256   0.329   0.396   0.457   1.908   0.539   0.442
11.400  0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.053   0.116   0.178   1.932   0.275   1.021
        6.371   8.247   9.305   10.081  10.632  11.112  11.254  11.386  11.516  11.645  11.773
```


Aalto University
School of Engineering