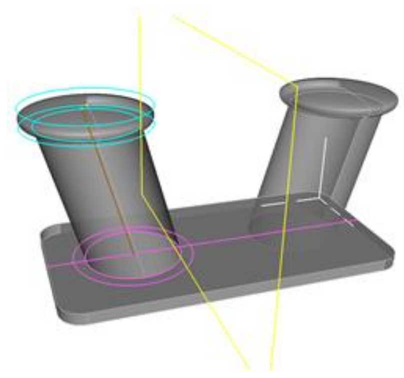
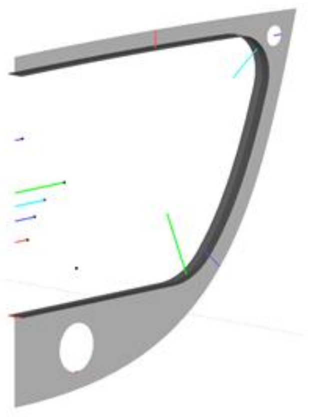
Components

Part 1 – Basics and Examples

by Reinhard Siegel

October 2021





Contents

Introduction

No design looks like the other. But boats, yachts and ships are similar. With components one can save time and effort. A component is a piece of coherent MultiSurf geometry that can be inserted into other models. Instead of creating in the work model the prefered construction for keel, rudder, deck, transom etc. each time entity by entity, they can be inserted with little effort using components.

With components, the structure of a model can be clearly arranged. A component can be used to detach a related group of entities from a large model, edit it in a separate model and insert it into other models.

This tutorial is aimed to explain how to load components into a model, how to create them, which tools are available. In part 1 the tutorial will introduce a number of components that are practical when building the geometry model of a boat. Part 2 will show numerous components to give models a realistic appearance.

Abbreviations used:

cp: control point (support point)
mc: master curve = support curve

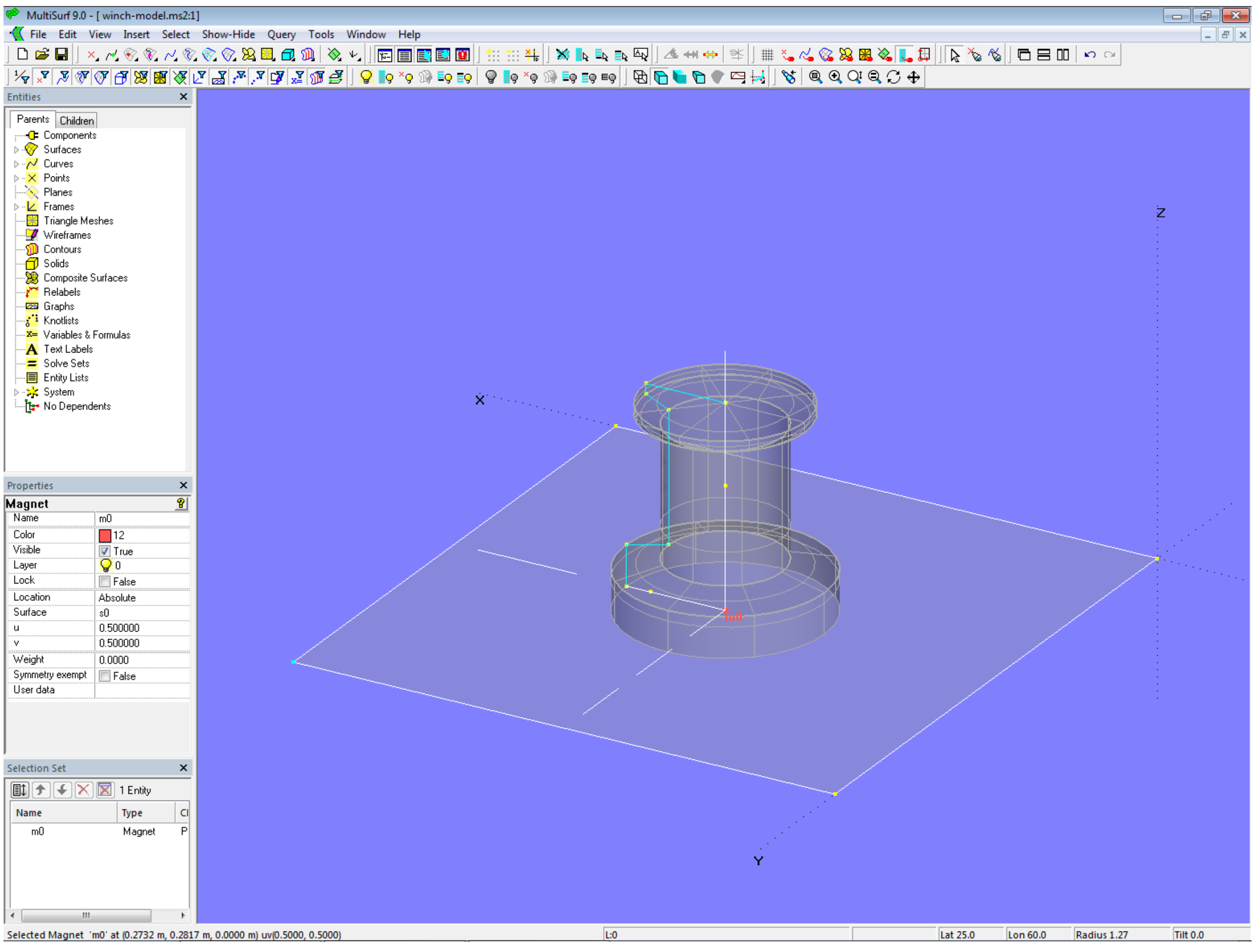
cp1, cp2, ...: denotes 1st, 2nd, ... point in the list of supports of a curve. It is not an actual entity name.
mc1, mc2, ...: denotes 1st, 2nd, ... curve in the list of supports of a surface. It is not an actual entity name.

In the following the terms used for point, curve and surface types are those of MultiSurf. This may serve the understanding and traceability.

Basics – component Winch

Component source model

As an introduction to the topic of components, let us consider the model *winch-model.ms2*. It contains the geometry of a simple winch. Magnet m0 is on the base surface s0; Offset Point p0 and Point p1 depend on it. With m0, p0 and p1 the 3-point Frame F is defined. In this user-defined coordinate system the points are created which determine the cross-sectional curve c0. This in turn is rotated around Line l0, which yields the Revolution Surface s1. If Magnet m0 is moved, the winch moves with it. The axis of rotation is always perpendicular to the base surface.



Magnet

Name	m0
Color	🟥 12
Visible	✓ True
Layer	0
Lock	False
Location	Absolute
Surface	s0
u	0.500000
v	0.500000
Weight	0.0000
Symmetry exempt	False
User data	

Name	Type	Cl
m0	Magnet	P

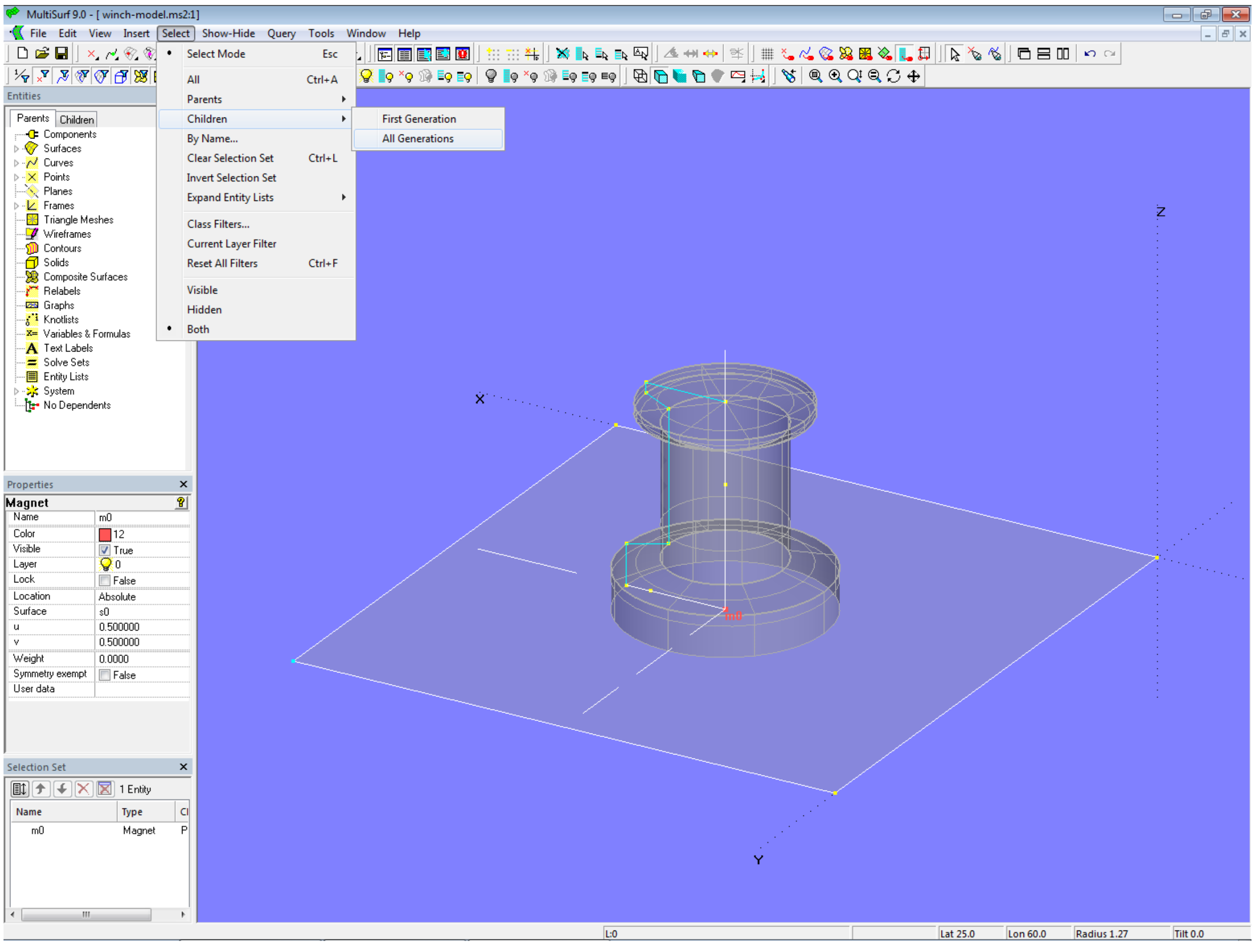
```
Selected Magnet  'm0' at (0.2732 m, 0.2817 m, 0.0000 m) uv(0.5000, 0.5000)    L:0    Lat 25.0    Lon 60.0    Radius 1.27    Tilt 0.0
```

Model winch-model.ms2 – winch as Revolution Surface in the source model

Winch-model.ms2 is not a component, but a normal MultiSurf model file (extension of the filename is *".ms2"*). It is the source model for the winch component. A component file has the extension *".mc2"*.

Saving the component

In general, a component needs parents from the host or working model, the model into which it will be inserted. In our example, the surface s0 on which the Magnet m0 is situated, will be replaced by a surface in the working model when the component is loaded. So let us select the magnet m0 in the first step.



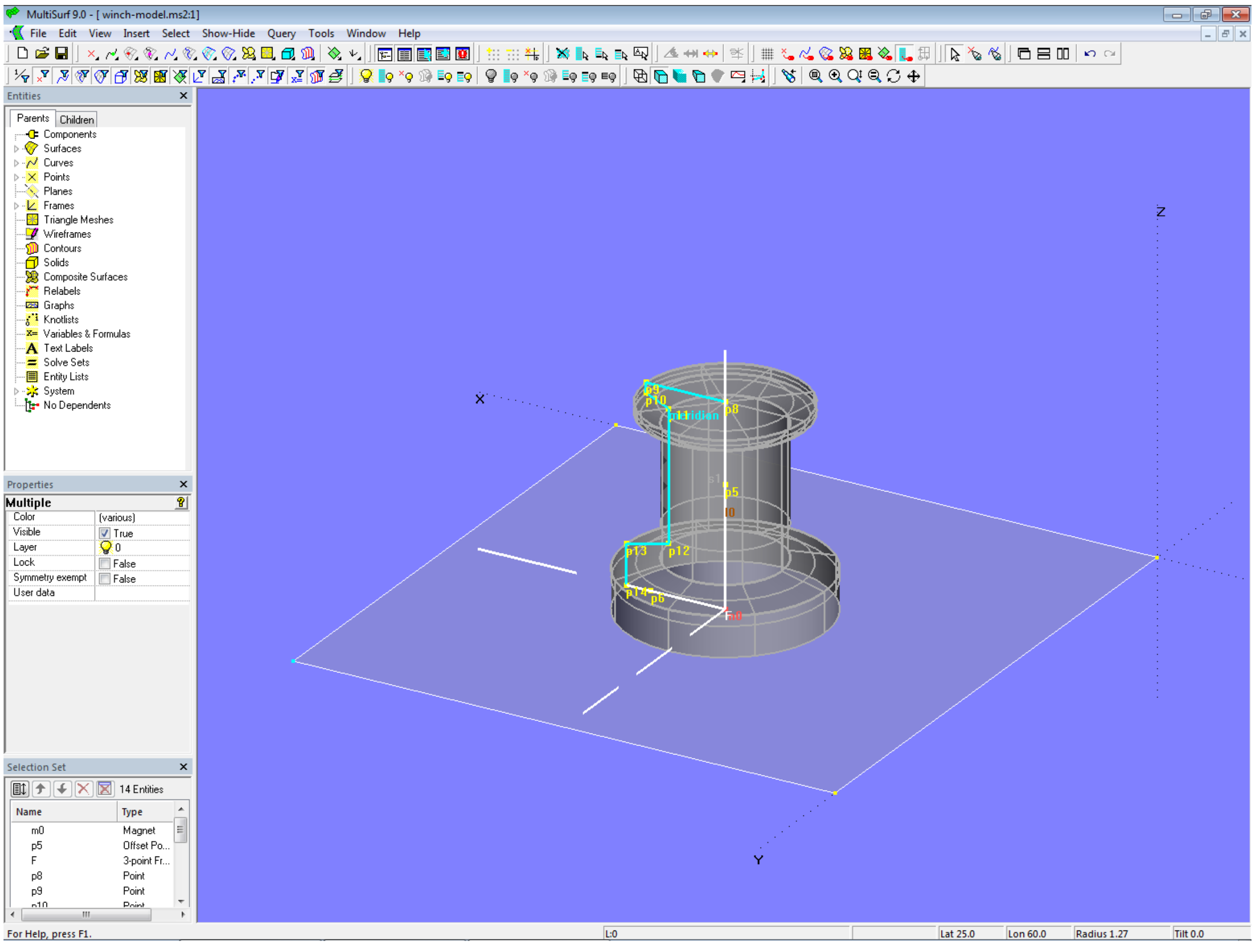
Magnet

Name	m0
Color	🟥 12
Visible	✓ True
Layer	0
Lock	False
Location	Absolute
Surface	s0
u	0.500000
v	0.500000
Weight	0.0000
Symmetry exempt	False
User data	

Name	Type	Cl
m0	Magnet	P

Model winch-model.ms2 – selection of all entities of the winch geometry depending on Magnet m0

And then in the second step, everything that depends on it: **Select/ Children/ All Generations**. All entities that depend on m0 are now in the Selection Set, i.e. the entire winch construction.



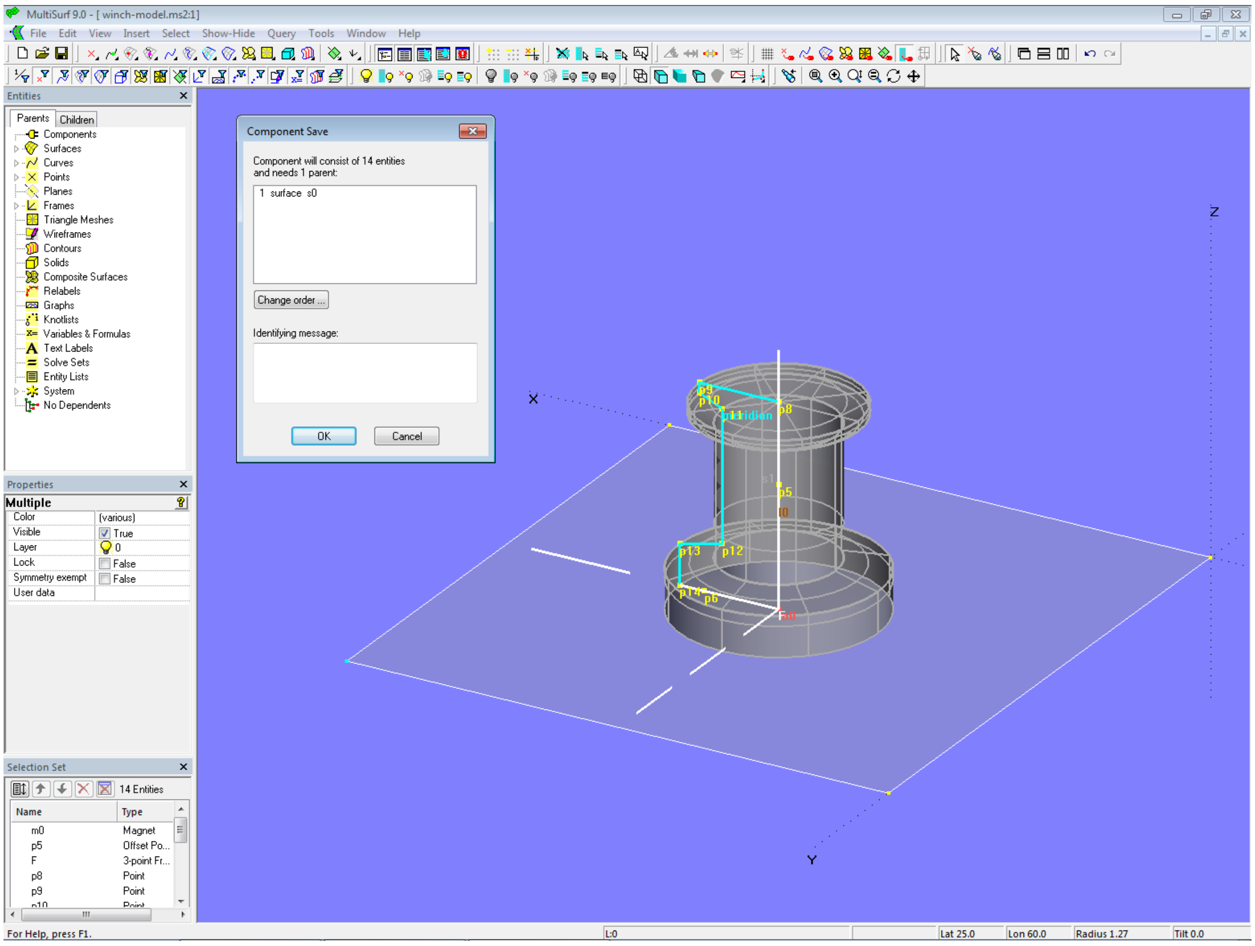
Multiple

Color	(various)
Visible	✓ True
Layer	0
Lock	False
Symmetry exempt	False
User data	

Name	Type
m0	Magnet
p5	Offset Po...
F	3-point Fr...
p8	Point
p9	Point
p10	Point

Model winch-model.ms2 - entities of the winch geometry dependent on magnet m0 in the source model

Now select **File/ Component/ Save** in the main menu, whereupon the following dialog box will open:



Component Save

Component will consist of 14 entities and needs 1 parent:

1 surface s0

Identifying message:

Multiple	
Color	(various)
Visible	True
Layer	0
Lock	False
Symmetry exempt	False
User data	

Name	Type
m0	Magnet
p5	Offset Po...
F	3-point Fr...
p8	Point
p9	Point
p10	Point

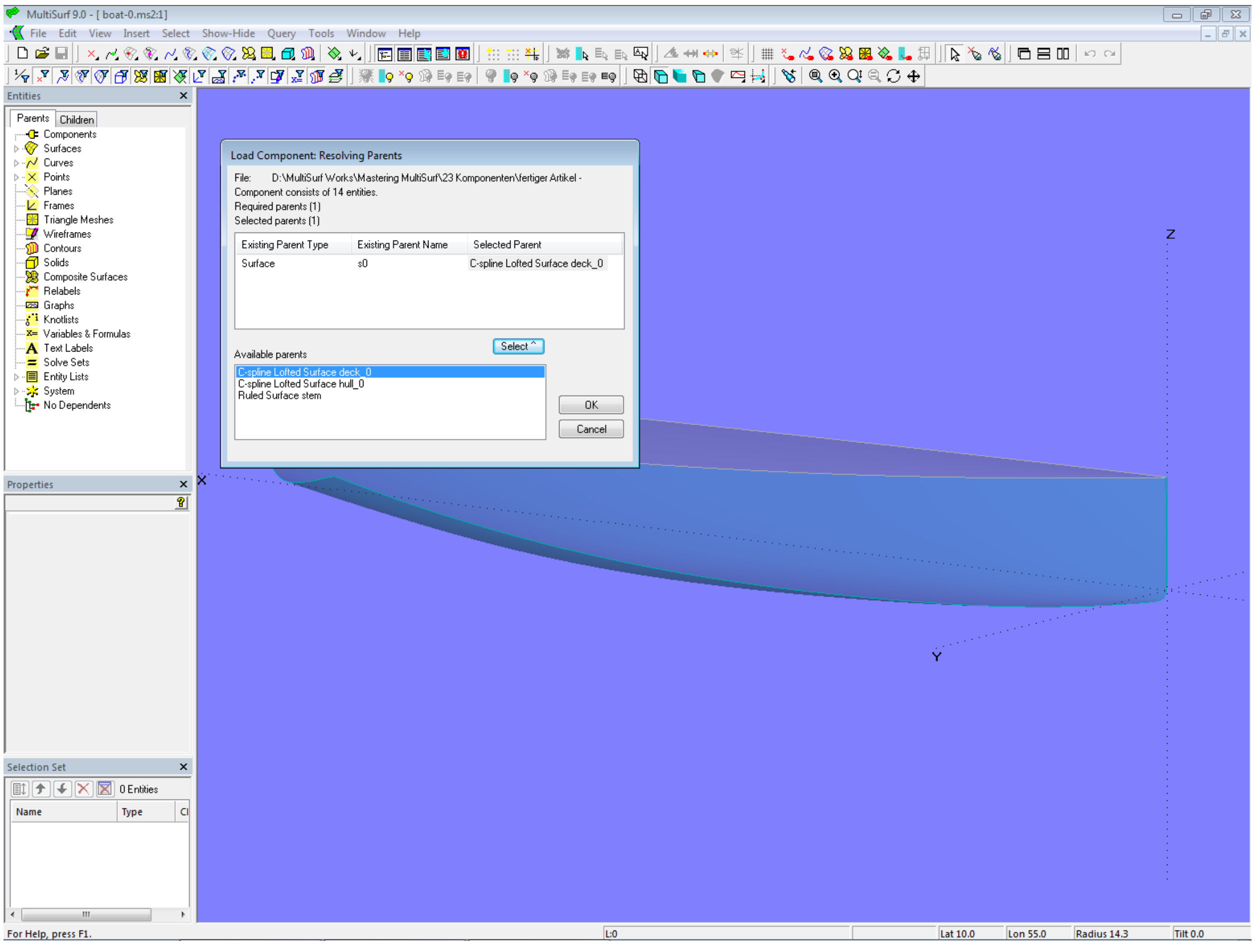
For Help, press F1. L:0 Lat 25.0 Lon 60.0 Radius 1.27 Tilt 0.0

Model winch-model.ms2 – saving the winch component in the source model

The model into which the winch component is to be loaded (host model, work model) has to provide a surface. Finally click the **OK** button and save the component under the name *winch-component.mc2*.

Loading the component

Let us try out how to insert the component into another model. Open the model *boat-0.ms2*. It contains a hull surface (hull_0) and a deck surface (deck_0). Then **File/ Component/ Load** and in the dialog window select the component file *winch-component.mc2*. Now the dialog box “Load Component: Resolving Parents” will appear. Its purpose is to select the parents to whom the component is connected when inserting it into the work model.



Load Component: Resolving Parents

File: D:\MultiSurf Works\Mastering MultiSurf\23 Komponenten\fertiger Artikel -
Component consists of 14 entities.
Required parents (1)
Selected parents (1)

Existing Parent Type	Existing Parent Name	Selected Parent
Surface	s0	C-spline Lofted Surface deck_0

Select ^

Available parents

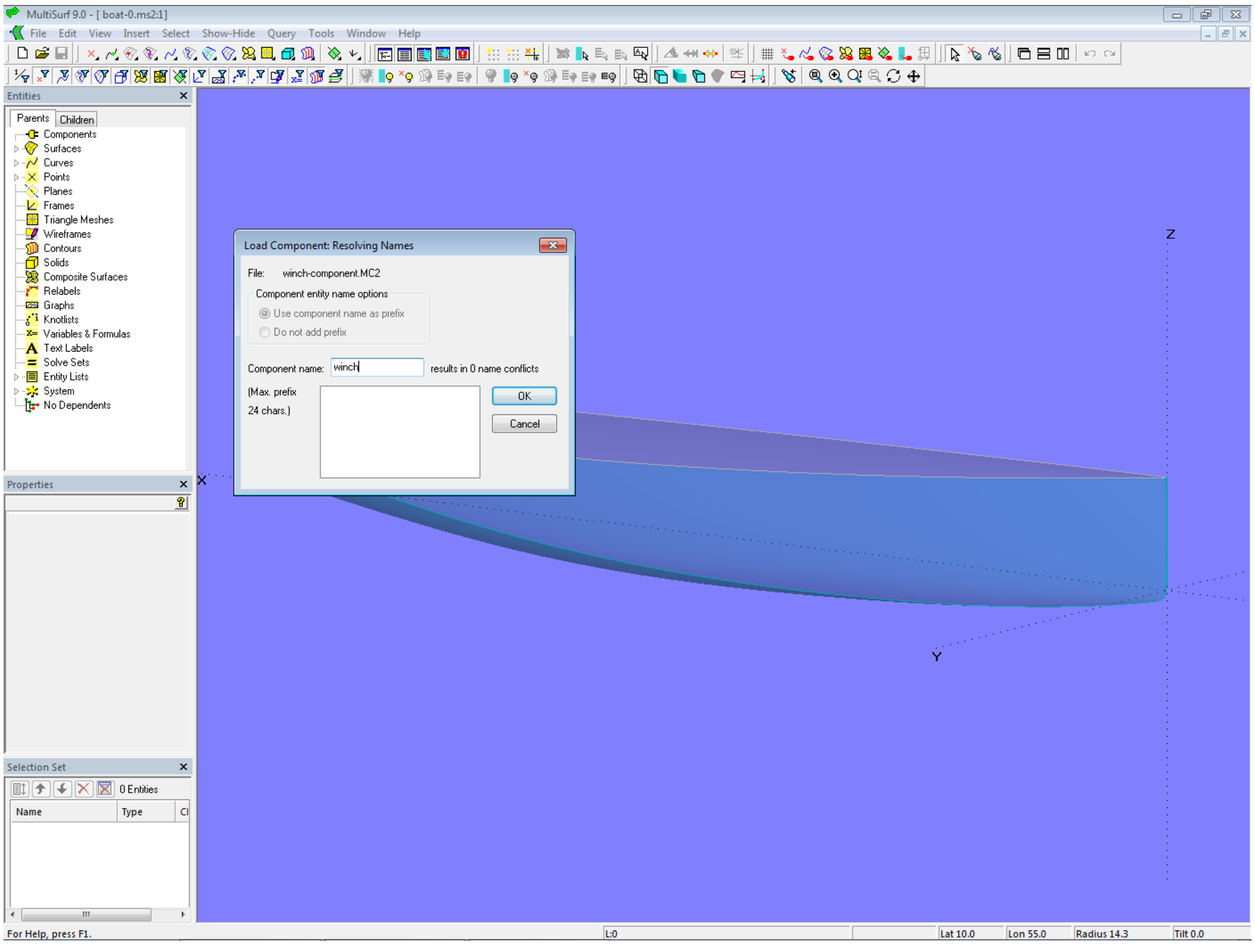
C-spline Lofted Surface deck_0
C-spline Lofted Surface hull_0
Ruled Surface stem

OK
Cancel

Model boat-0.ms2 – parent selection when loading the winch component into the work model

In this example, it is the deck surface deck_0 that replaces the surface s0 from the source model.

After confirming with **OK** the dialog box "Load Component: Resolving Names" is displayed. It is used to give the component a name in the host model and resolve naming conflicts. In our example, the component is given the name "winch". This string is prefixed to all entities that are inserted by the component. By using this name there are no entity name conflicts.



Load Component: Resolving Names

File: winch-component.MC2

Component entity name options

[✓ Use component name as prefix]

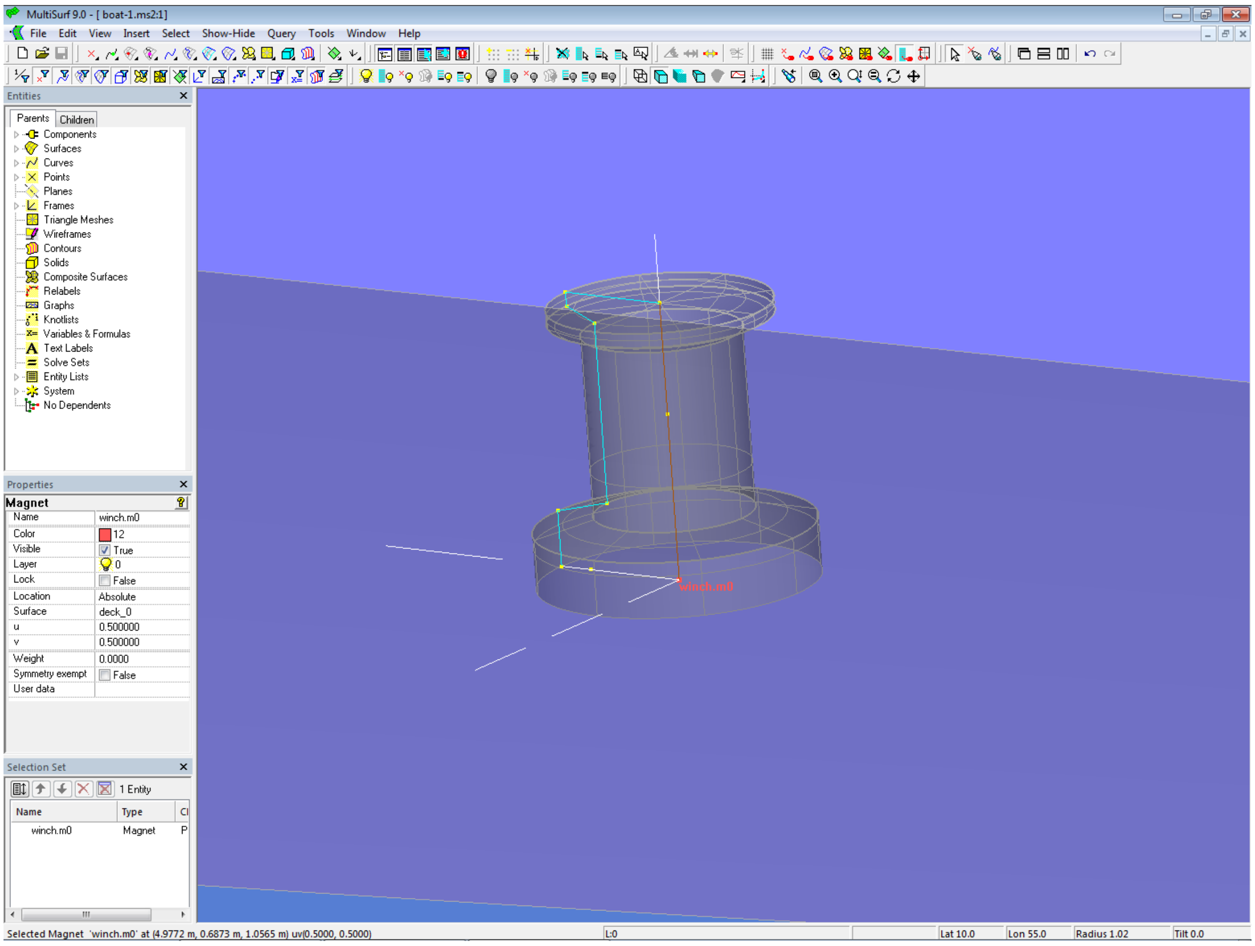
Do not add prefix

Component name: winch results in 0 name conflicts

(Max. prefix 24 chars.)

Model boat-0.ms2 – entering the name of the winch component when loading into the work model

After confirming with **OK**, the winch appears on the deck surface. With Magnet winch.m0 can be moved to the desired position. Now save the model using the filename *boat-1.ms2*.



Properties

Magnet

Name	winch.m0
Color	🟥 12
Visible	✓ True
Layer	0
Lock	False
Location	Absolute
Surface	deck_0
u	0.500000
v	0.500000
Weight	0.0000
Symmetry exempt	False
User data	

Selection Set

1 Entity

Name	Type	Cl
winch.m0	Magnet	P

Selected Magnet 'winch.m0' at (4.9772 m, 0.6873 m, 1.0565 m) uv(0.5000, 0.5000) L:0 Lat 10.0 Lon 55.0 Radius 1.02 Tilt 0.0

Model boat-1.ms2 – component winch added to the work model

Editing of components in the Entities Manager

In the Entities Manager the top category is "Components". Here components are listed under the names assigned at loading. “Components” by itself features a context menu.

Function mouse right click on "Components"

If you click with the right mouse button on "Components", a context menu with 2 options is displayed:
Load – load a component (alternative for File/ Component/ Load)
Change order – change the order in which components are displayed in the Entities Manager

Function mouse right click on the name of a component

There is another context menu. If you click with the right mouse button on the name of a listed component, the following options are available:
Select – selects all entities of the component; practical for query purposes, layer modification
Delete – deletes all entities of the component and removes it from the Entity Manager
Show – sets the property "Visible" of all entities of the component to "True"
Hide – sets the property "Visible" of all entities of the component to "False"
Make internal – it can sometimes be useful to include a component in the main body of the host model. For example if prefixes should be removed or if a little construction component was added which should not be separated from the model with its own headline. **Make internal** removes all prefixes and deletes the component designation. Possible name conflicts can be resolved with the help of a special dialog window.

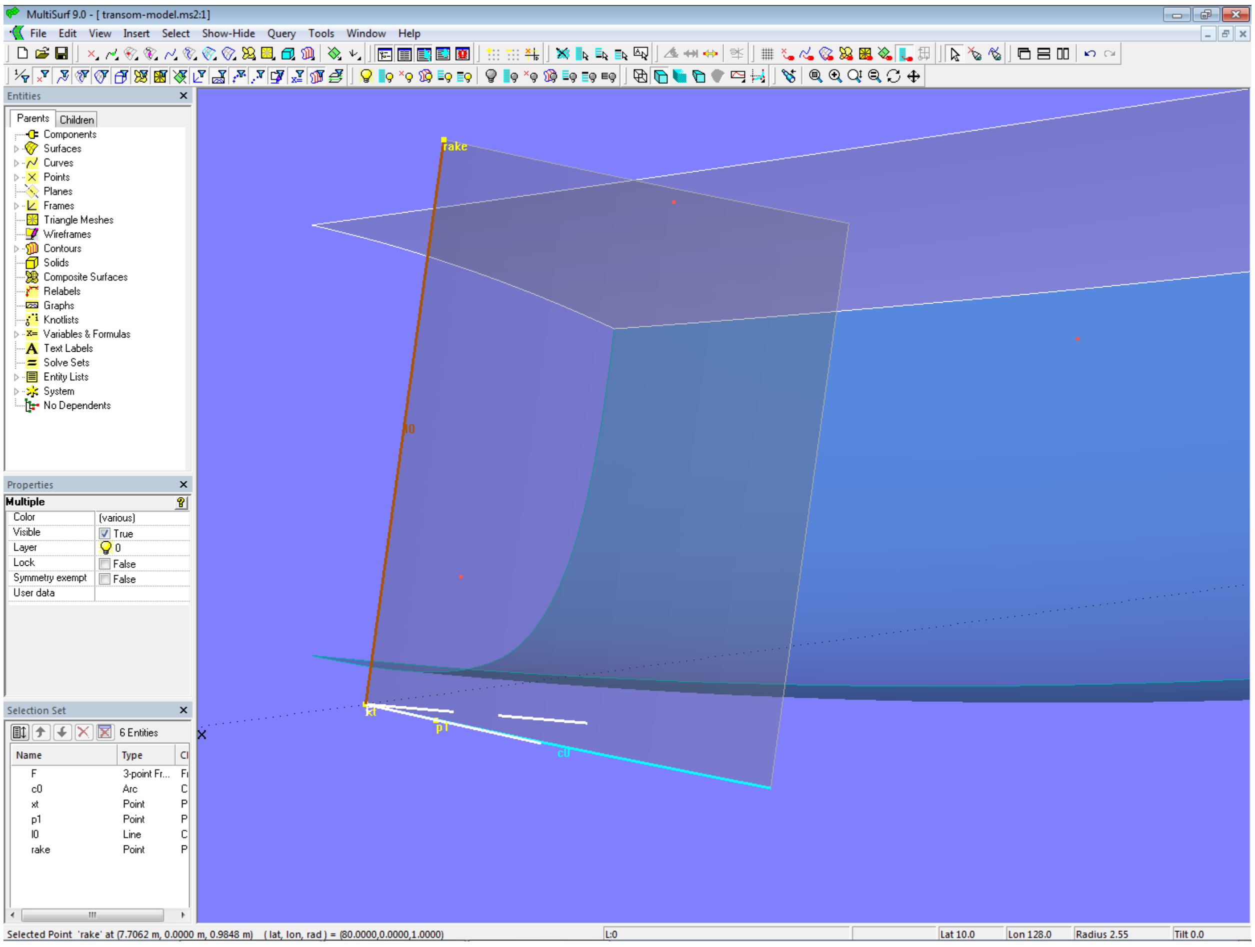
Current – a current component is similar to a current layer. All subsequently inserted entities are added to the current component.

Component Transom

We now want to create the geometry for another component, save it as a component and then load it into the model *boat-1.ms2*. The component should represent a circular cylindrical transom.

Transom source model

The model *transom-model.ms2* serves as the starting model. It contains the hull surface hull_0 and the deck surface deck_0. Also there is the base surface of the transom, transom_0. This is a Translation Surface with curve c0 (Arc) as guide and Line l0 as generator. All points for c0 and l0 are defined in the 3-point Frame F. For its part, F is determined by Point xt (origin of the frame on the X-axis), Point rake (length and inclination of the centerline of the transom surface) and Point p1 (abeam of xt).



Properties

Multiple	
Color	(various)
Visible	☑ True
Layer	0
Lock	☐ False
Symmetry exempt	☐ False
User data	

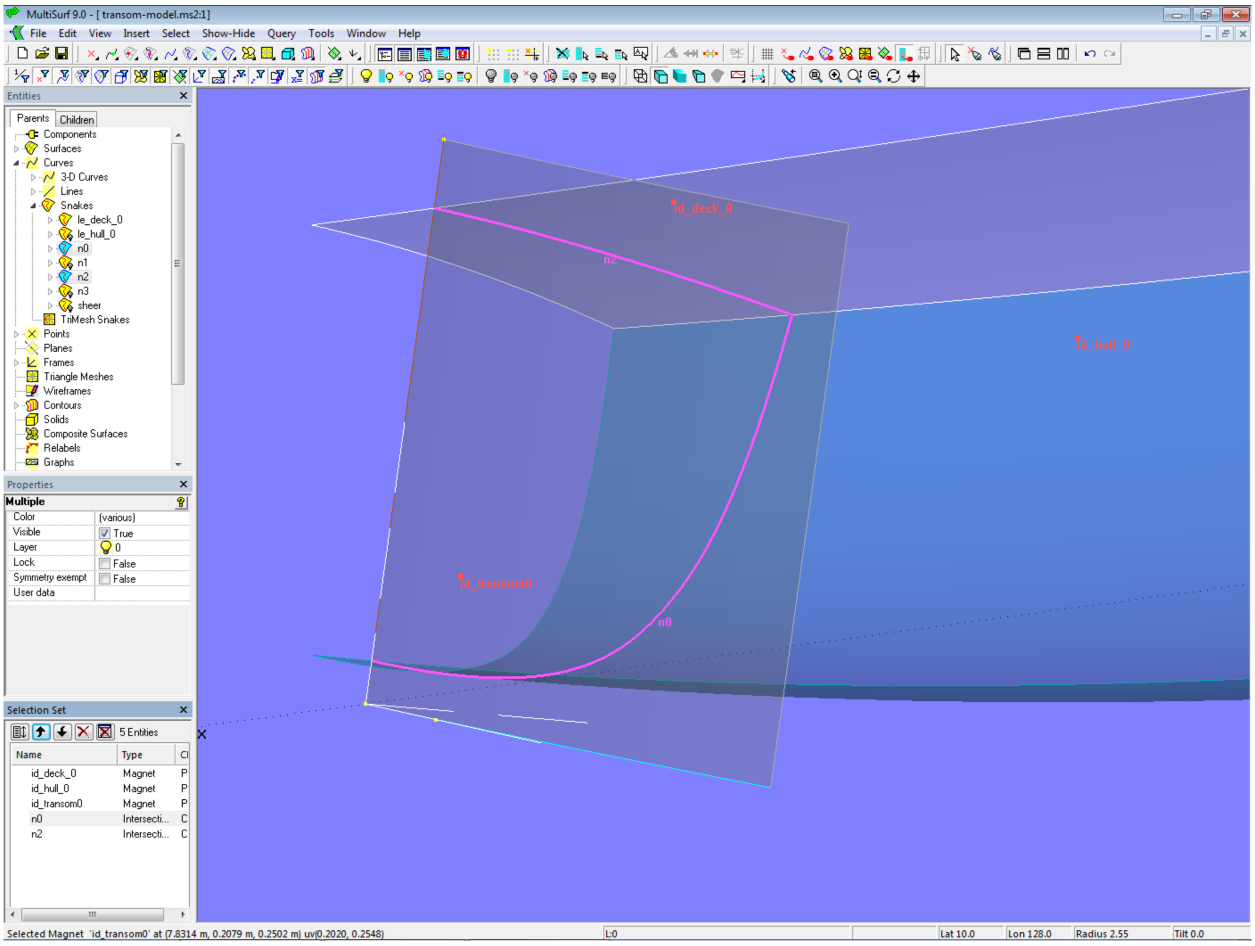
Selection Set — 6 Entities

Name	Type	Cl
F	3-point Fr...	Fi
c0	Arc	C
xt	Point	P
p1	Point	P
l0	Line	C
rake	Point	P

```
Selected Point  'rake' at (7.7062 m, 0.0000 m, 0.9848 m)   ( lat, lon, rad ) = (80.0000,0.0000,1.0000)   L:0   Lat 10.0   Lon 128.0   Radius 2.55   Tilt 0.0
```

Model transom-model.ms2 – the base surface transom_0 of the circular cylindrical transom is created by moving Line l0 along Arc c0.

The transom base surface transom_0 intersects the hull surface hull_0 in the Intersection Snake n0. Likewise it cuts the deck surface deck_0 in the Intersection Snake n2.



Properties

Multiple

Color	(various)
Visible	☑ True
Layer	0
Lock	☐ False
Symmetry exempt	☐ False
User data	

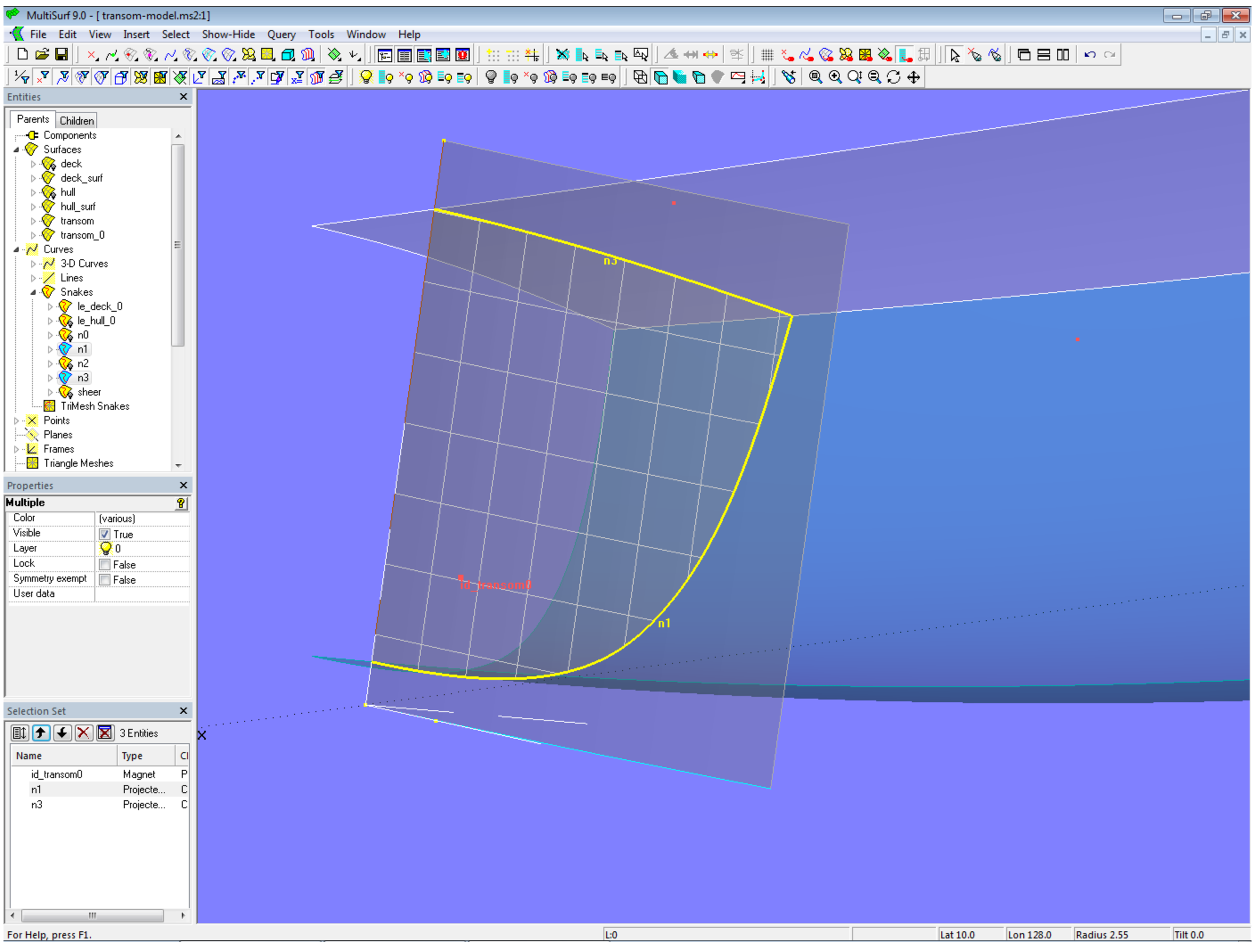
Selection Set — 5 Entities

Name	Type	Cl
id_deck_0	Magnet	P
id_hull_0	Magnet	P
id_transom0	Magnet	P
n0	Intersecti...	C
n2	Intersecti...	C

Selected Magnet 'id_transom0' at (7.8314 m, 0.2079 m, 0.2502 m) uv(0.2020, 0.2548) L:0 Lat 10.0 Lon 128.0 Radius 2.55 Tilt 0.0

Model transom-model.ms2 – transom base surface transom_0 cuts hull and deck in the Intersection Snakes n0 and n2.

Both snakes are projected onto the transom base surface as Projected Snakes n1 and n3. The final transom surface is then created with these two snakes by Trimmed Surface transom.



Properties

Multiple

Color	(various)
Visible	✓ True
Layer	0
Lock	False
Symmetry exempt	False
User data	

Selection Set

3 Entities

Name	Type	Cl
id_transom0	Magnet	P
n1	Projecte...	C
n3	Projecte...	C

Model transom-model.ms2 – final transom surface (Trimmed Surface transom) in the source model

Next two Entity Lists are created. The Entity List parents contains the surfaces hull_0 and deck_0. The Entity List products just holds the Trimmed Surface transom. The purpose of these lists is explained in the following section.

Finally the source model of the transom component is saved as *transom-model.ms2*.

Saving the component Transom

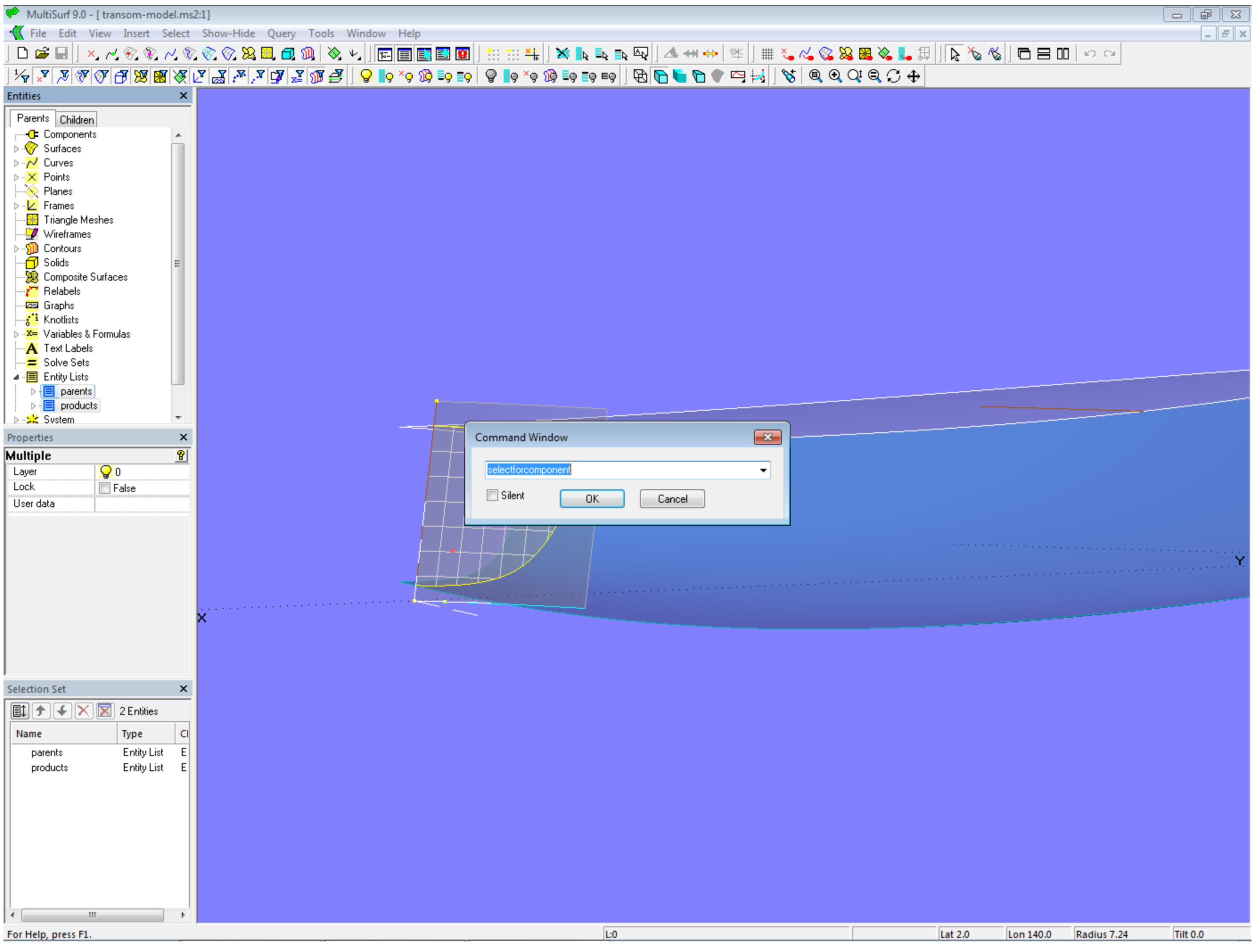
Command SelectForComponent – the perfect tool for creating a component

We now want to save the transom model as a component. The host or work model, i.e. the model into which the component is to be inserted, must provide a hull and a deck surface (parents of the component). So we have to select all entites, that create the final transom surface, but not these two surfaces. If we were to select hull and deck and then, as in the case of the winch component use again **Select/ Children/ All Generations** the Selection Set would possibly contain dependent entities (children) of these surfaces, which have nothing to do with the transom, such as the Contours dwl_0, buttock_0 etc., which are also included in the source model and depend on deck and hull. Though momentarily hidden, those would also be selected.

If the source model is specially made for the creation of a component and as with the Winch component only requires a single parent from the host model, the easiest way for selection is via **Select/ Children/ All Generations**. But if you want to extract a component from a large geometry model or select entities for a component that requires more than one parent from the host model it quickly become complicated, because you always have to consider all dependencies in order not to include parents you do not want.

To simplify the selection process, there is the command **SelectForComponent** in MultiSurf. It is extremely useful when creating components. Because it selects the minimum set of entities required in order to generate the entities in the Entity List "products" for the parents specified in the Entity List "parents". The **SelectForComponent** command selects all necessary component entities fast and effectively.

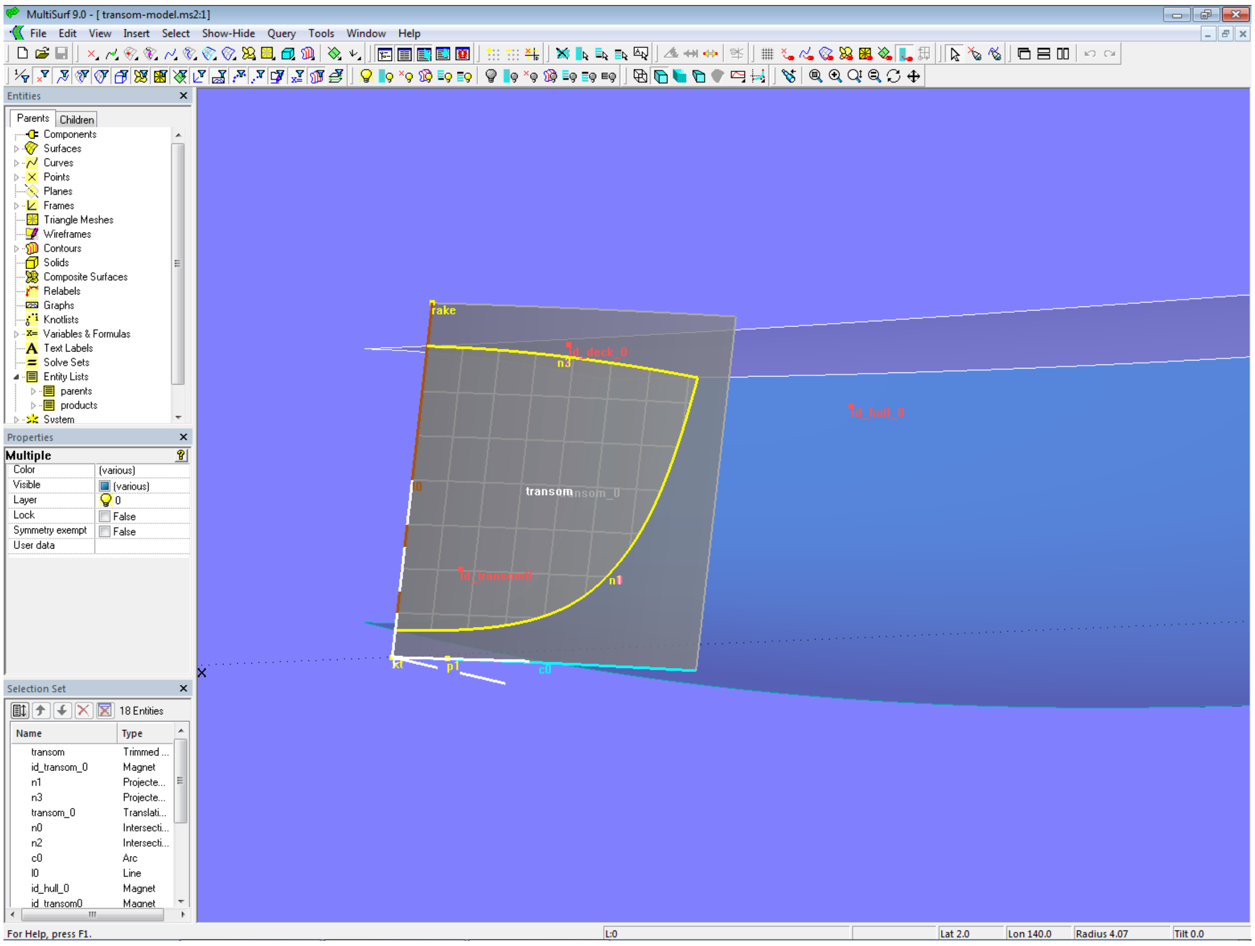
So let us now select the two Entity Lists parents and products and enter the command **SelectForComponent** via **Tools/Command Window**.



Name	Type	Cl
parents	Entity List	E
products	Entity List	E

Model transom-model.ms2 – selection of the component entities via the command "SelectForComponent" in the source model

After **OK**, the Selection Set Manager then contains all the entities required for the transom component.

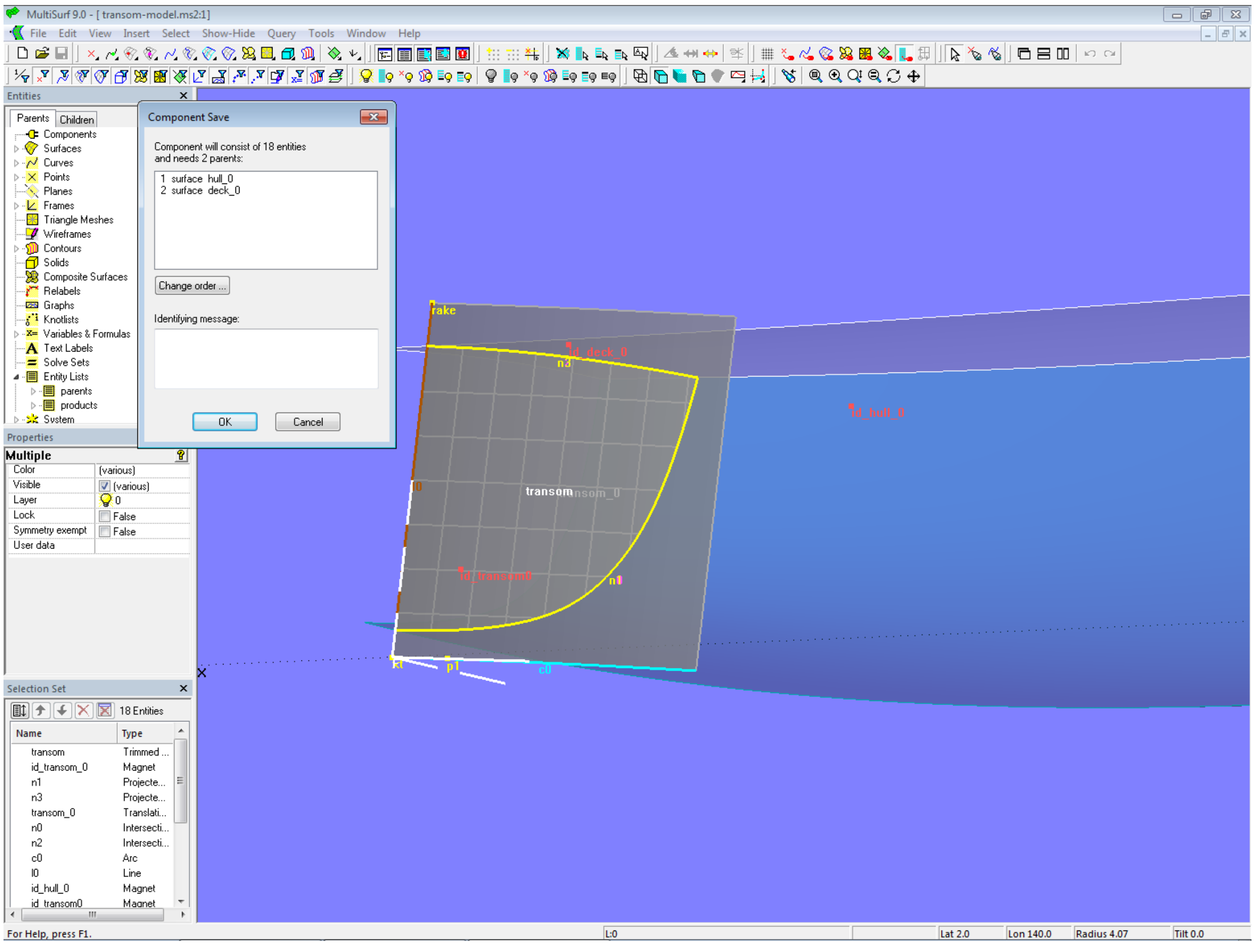


Multiple	
Color	(various)
Visible	(various)
Layer	0
Lock	False
Symmetry exempt	False
User data	

Name	Type
transom	Trimmed ...
id_transom_0	Magnet
n1	Projecte...
n3	Projecte...
transom_0	Translati...
n0	Intersecti...
n2	Intersecti...
c0	Arc
l0	Line
id_hull_0	Magnet
id_transom0	Magnet

Model transom-model.ms2 – entities of the transom component selected via the command “SelectForComponent” in the source model

It continues with **File/ Component/ Save.** The "Component Save" dialog box appears showing which parents the component expects from the host model.



Component Save

Component will consist of 18 entities
and needs 2 parents:

1 surface hull_0
2 surface deck_0

Identifying message:

Name	Type
transom	Trimmed ...
id_transom_0	Magnet
n1	Projecte...
n3	Projecte...
transom_0	Translati...
n0	Intersecti...
n2	Intersecti...
c0	Arc
l0	Line
id_hull_0	Magnet
id_transom0	Magnet

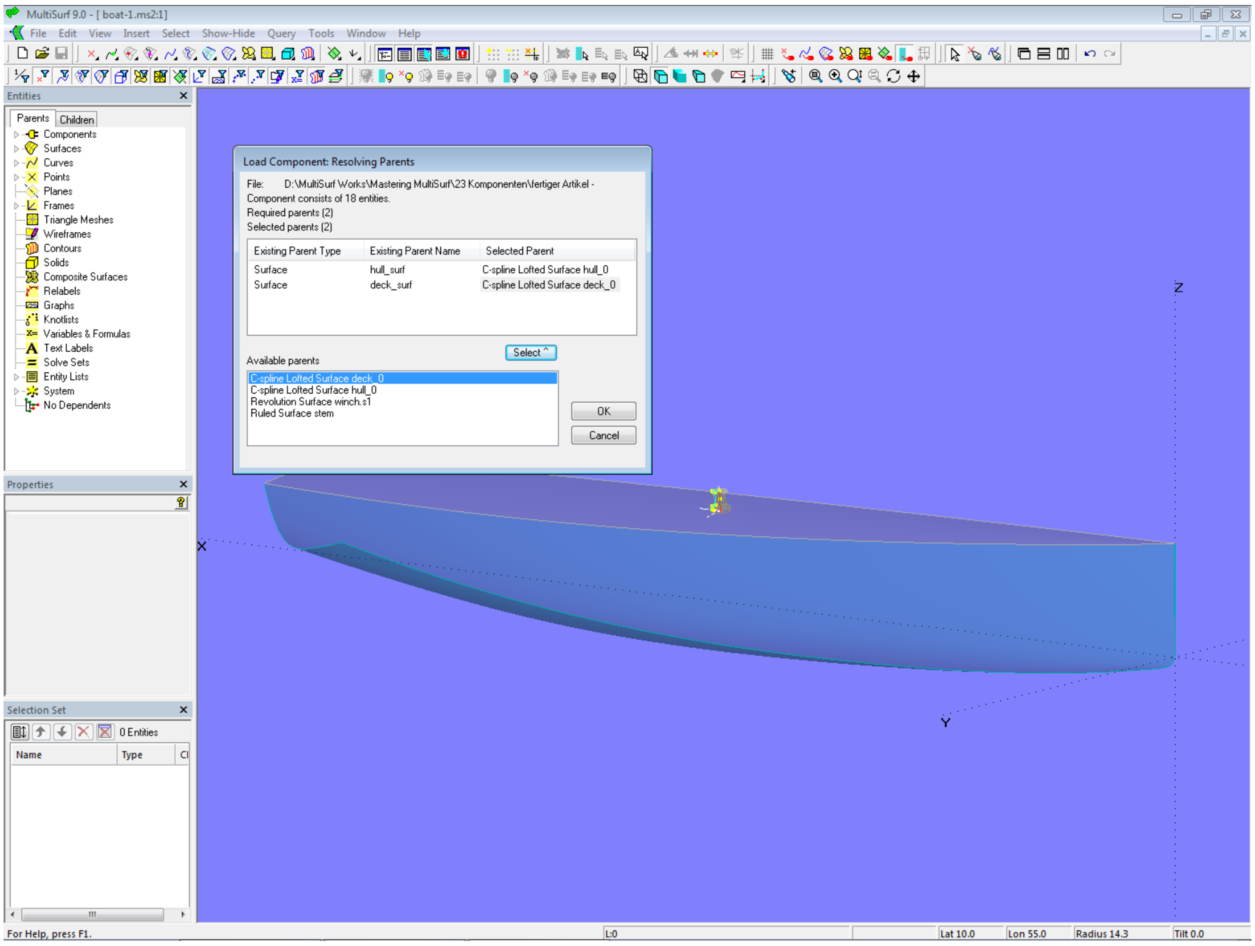
Model transom-model.ms2 - the transom component requires 2 parents in the work model

Then hit **OK** and save the transom component under the name *transom-component.mc2*.

Loading the component Transom

Now let us load the transom component into the work or host model *boat-1.ms2*. Open this model and then via **File/ Component/ Load** select the component file *transom-component.mc2* and open it. Or alternatively right-mouse click on “Components” in the Entities Manager and from the context menu choose “Load”.

In the window "Load Component: Resolving Parents" select the corresponding surfaces, to be used by the component. **OK** then.



Load Component: Resolving Parents

File: D:\MultiSurf Works\Mastering MultiSurf\23 Komponenten\fertiger Artikel -
Component consists of 18 entities.
Required parents (2)
Selected parents (2)

Existing Parent Type	Existing Parent Name	Selected Parent
Surface	hull_surf	C-spline Lofted Surface hull_0
Surface	deck_surf	C-spline Lofted Surface deck_0

Select ^

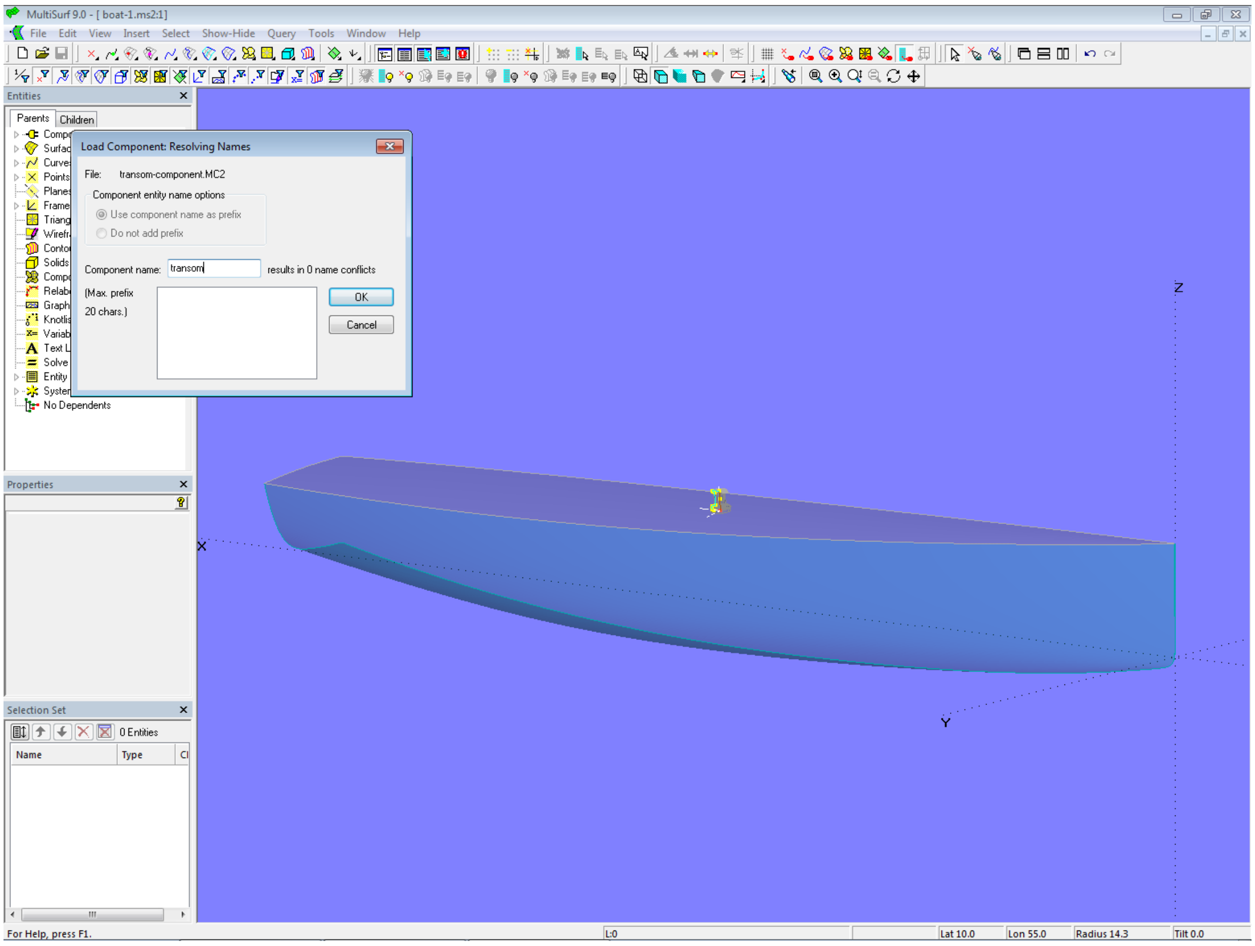
Available parents

C-spline Lofted Surface deck_0
C-spline Lofted Surface hull_0
Revolution Surface winch.s1
Ruled Surface stem

OK
Cancel

Model boat-1.ms2 – selection of parents when loading the transom component into the work model

In the "Load Component: Resolving Names" window enter the name of the component: transom, then **OK**.


Load Component: Resolving Names

File: transom-component.MC2

Component entity name options

[✓ Use component name as prefix]

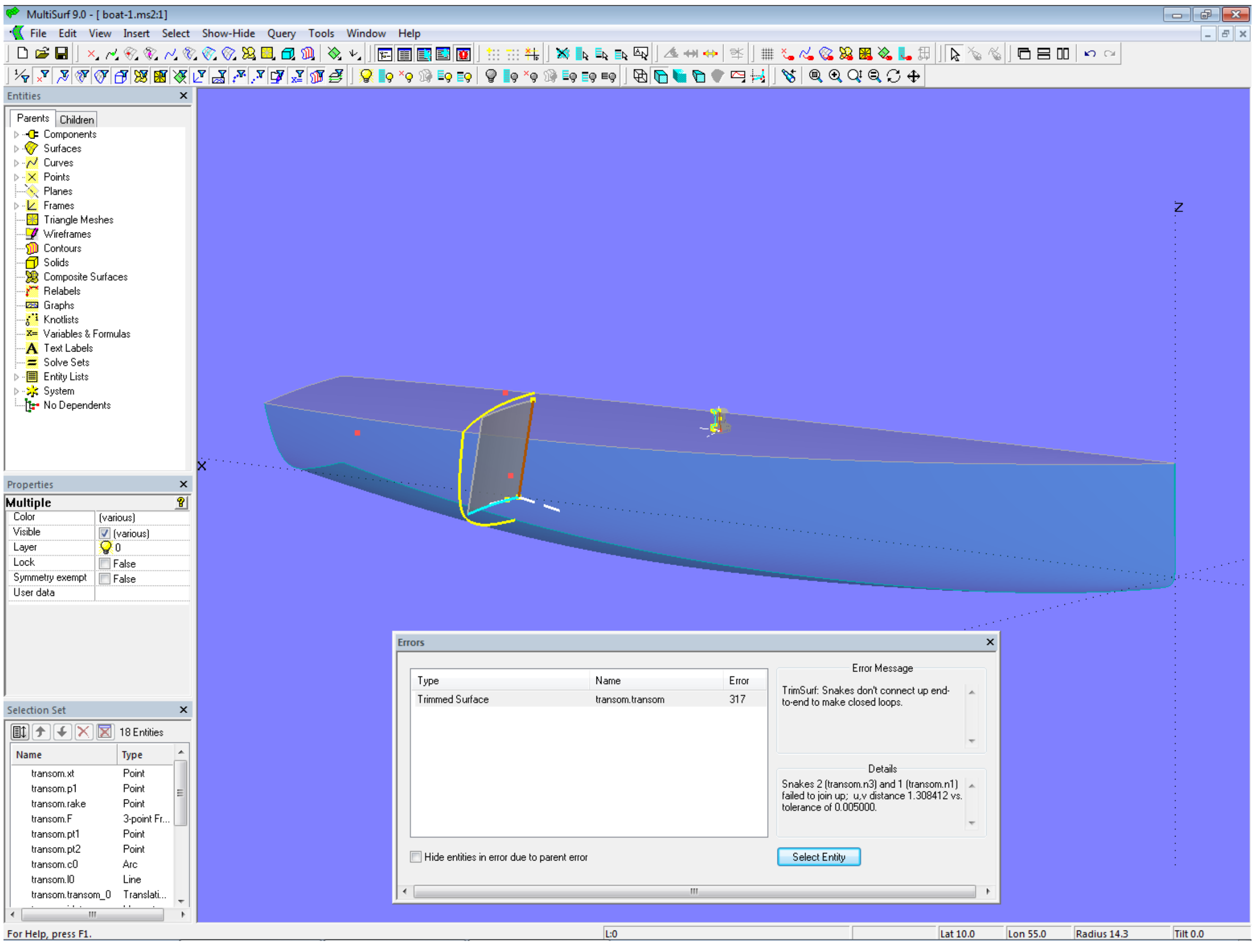
Do not add prefix

Component name: transom results in 0 name conflicts

(Max. prefix 20 chars.)

Model boat-1.ms2 –when loading the transom component into the host model it is given the name transom

Now the entities of the transom component are displayed, but also an error message.


MultiSurf 9.0 - [boat-1.ms2:1]

Properties

Multiple

Color	(various)
Visible	✓ (various)
Layer	0
Lock	False
Symmetry exempt	False
User data	

Selection Set — 18 Entities

Name	Type
transom.xt	Point
transom.p1	Point
transom.rake	Point
transom.F	3-point Fr...
transom.pt1	Point
transom.pt2	Point
transom.c0	Arc
transom.l0	Line
transom.transom_0	Translati...

Errors

Type	Name	Error
Trimmed Surface	transom.transom	317

Error Message

TrimSurf: Snakes don't connect up end-to-end to make closed loops.

Details

Snakes 2 (transom.n3) and 1 (transom.n1) failed to join up; u,v distance 1.308412 vs. tolerance of 0.005000.

Hide entities in error due to parent error

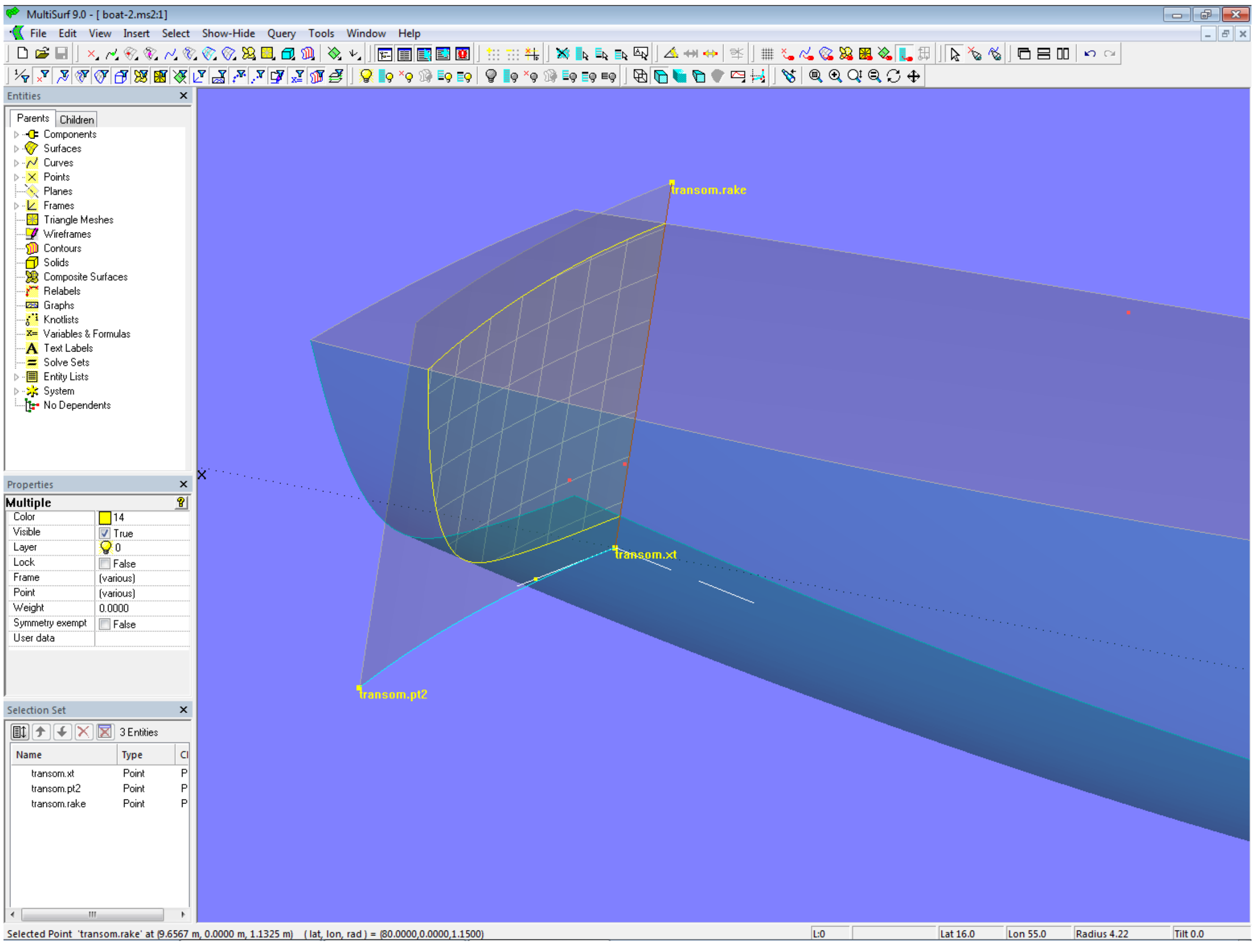
For Help, press F1.

Model boat-1.ms2 - the transom component causes an error message.

The reason for the error message is easy to see: the base surface transom.transom_0 is too small both in width and height, and it is also located pretty far ahead. Because the hull surface in the source model from which the component was saved (LOA = 8 m), is smaller than the hull surface in the host model in which it is loaded (LOA = 10 m).

What do you have to do? Only move Point transom.xt in the area of the aft overhang, and with Points transom.pt2 and transom.rake adjust width and height of the base surface transom.transom_0 to hull and deck.

Then save the model as *boat-2.ms2*.



Properties

Multiple

Color	14
Visible	☑ True
Layer	0
Lock	☐ False
Frame	(various)
Point	(various)
Weight	0.0000
Symmetry exempt	☐ False
User data	

Selection Set

3 Entities

Name	Type	Cl
transom.xt	Point	P
transom.pt2	Point	P
transom.rake	Point	P

Selected Point 'transom.rake' at (9.6567 m, 0.0000 m, 1.1325 m) (lat, lon, rad) = (80.0000,0.0000,1.1500) L:0 Lat 16.0 Lon 55.0 Radius 4.22 Tilt 0.0

Model boat-2.ms2 – final circular cylindrical transom after adjusting base area in the work model

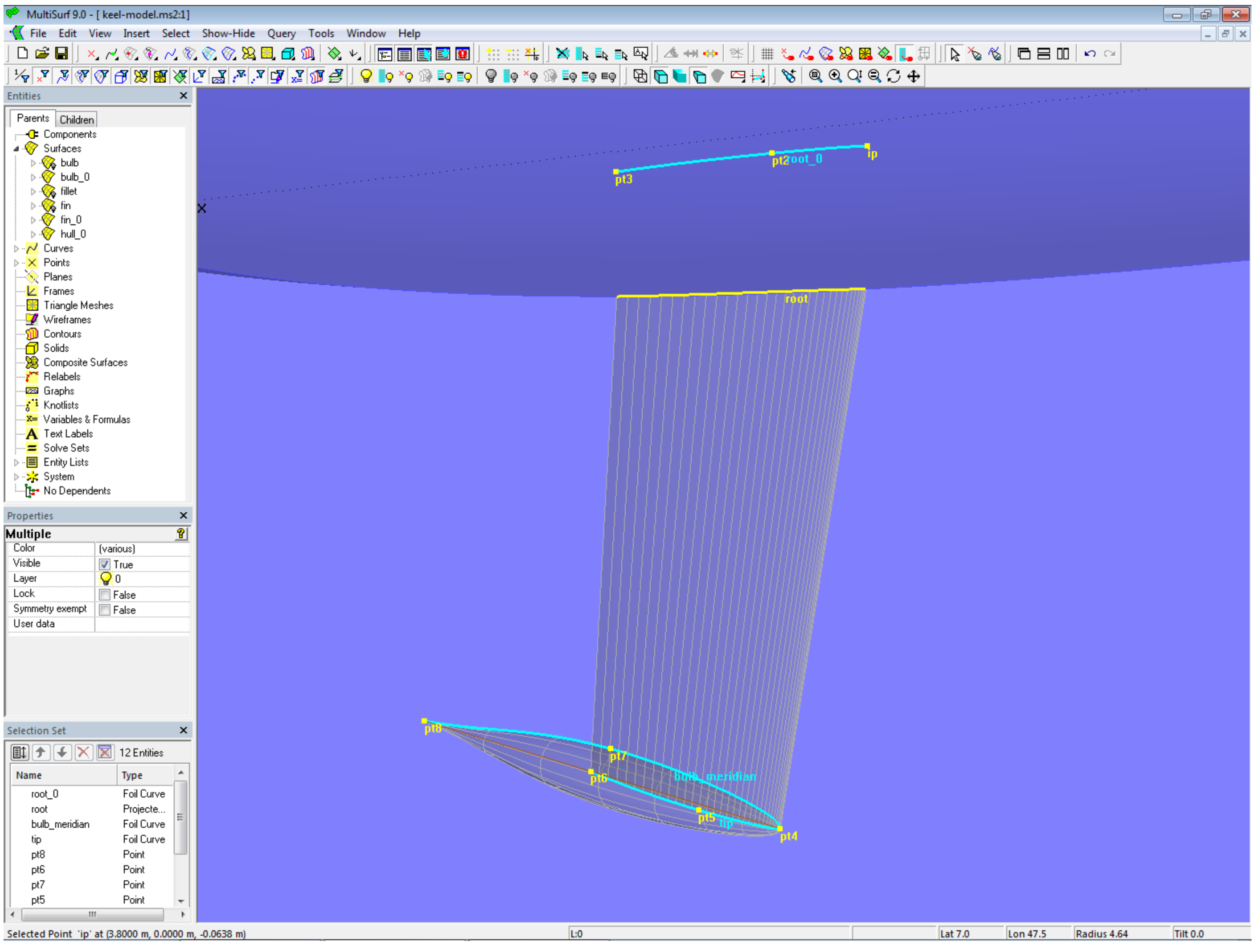
So much for the transom component.

Component Keel

Keel source model

Starting point is the model *keel-model.ms2*. It contains a keel appendage consisting of fin and ballast-bulb as well as a fillet between the two. The root section of the fin on the X-axis is formed by the Foil Curve root_0, defined with the Points ip (leading edge), pt2 (root section thickness) and pt3 (trailing edge). The root section on the hull surface is created by the Projected Snake root. The Foil Curve tip determines the tip section, defined with the points pt4 (leading edge), pt5 (tip section thickness) and pt6 (trailing edge). Between curves root and tip the Ruled Surface fin_0 is spanned as the base of the fin surface.

The ballast bulb is a Revolution Surface. Meridian is Foil Curve bulb_meridian, determined with Points pt4 (leading edge), pt7 (thickness) and pt8 (trailing edge). Axis of rotation is Line bulb_axis between pt4 and pt8.



Multiple

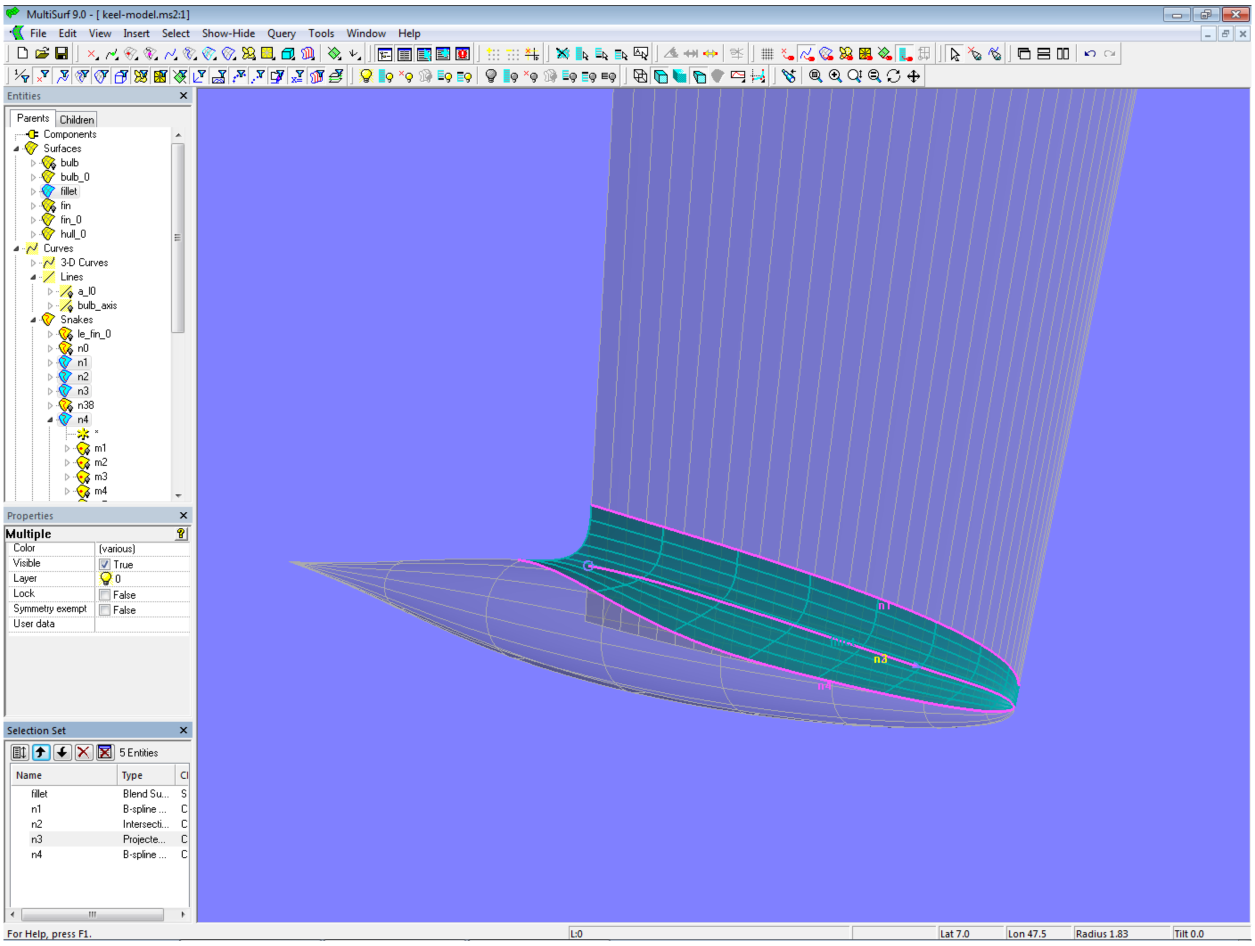
Color	(various)
Visible	✓ True
Layer	0
Lock	False
Symmetry exempt	False
User data	

Name	Type
root_0	Foil Curve
root	Projecte...
bulb_meridian	Foil Curve
tip	Foil Curve
pt8	Point
pt6	Point
pt7	Point
pt5	Point

Selected Point 'ip' at (3.8000 m, 0.0000 m, -0.0638 m) L:0 Lat 7.0 Lon 47.5 Radius 4.64 Tilt 0.0

Model keel-model.ms2 – basic entities of fin and bulb construction in the source model

The rounding between fin and bulb is the Blend Surface fillet. It requires 4 snakes, two on one surface and two on the other. B-spline Snake n1 determines the start of rounding on the fin. Intersection Snake n2 is the cut of the fin surface by the bulb. In turn, it is then projected on the bulb surface as Projected Snake n3. The run-out of the rounding on the bulb defines the B-spline Snake n4.



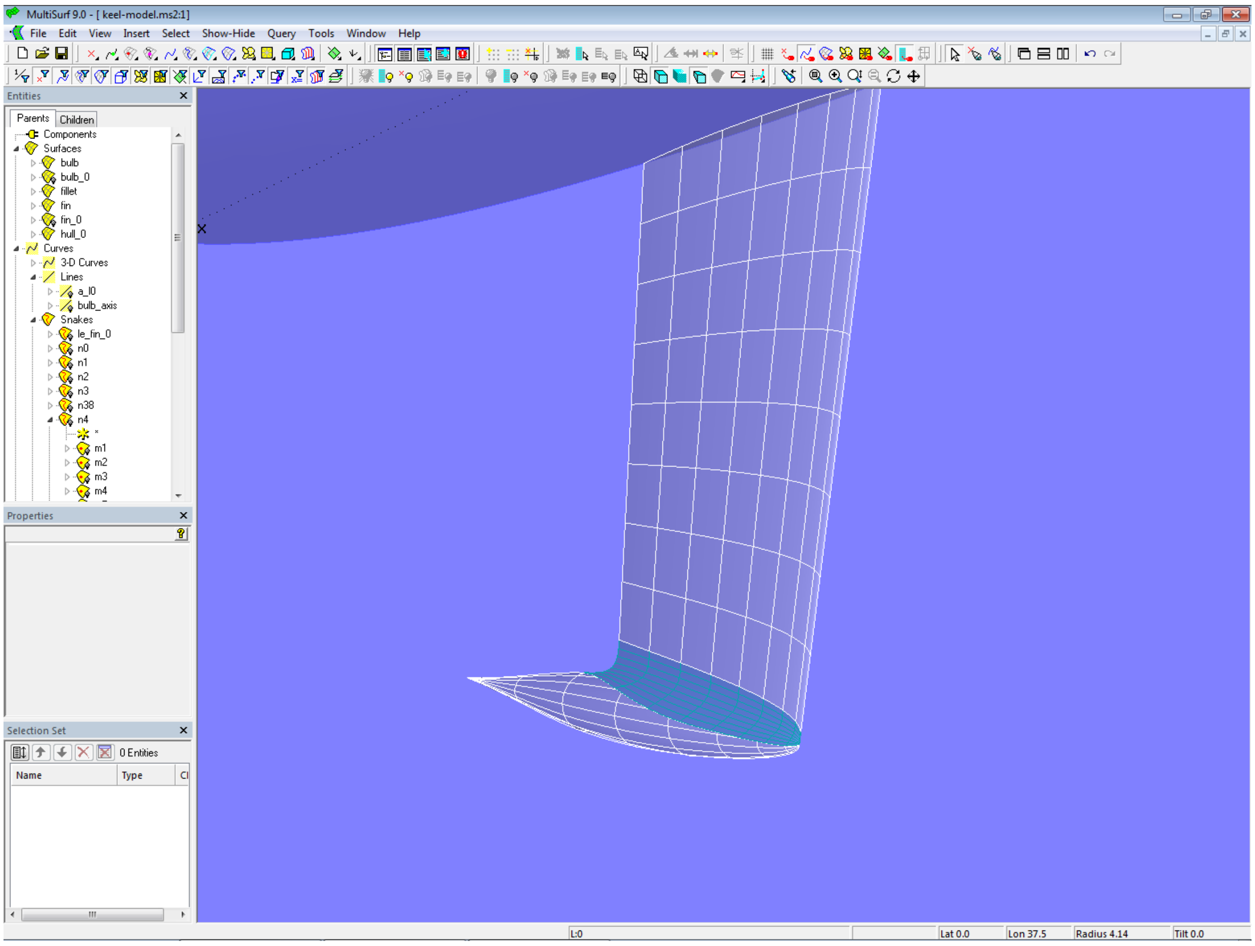
Multiple

Color	(various)
Visible	✓ True
Layer	0
Lock	False
Symmetry exempt	False
User data	

Name	Type	Cl
fillet	Blend Su...	S
n1	B-spline ...	C
n2	Intersecti...	C
n3	Projecte...	C
n4	B-spline ...	C

Model keel-model.ms2 - rounding between fin and bulb with Blend Surface

The surface portion from the fin root to the beginning of the rounding fillet is the SubSurface fin, Trimmed Surface bulb is the portion of the bulb minus the rounding.

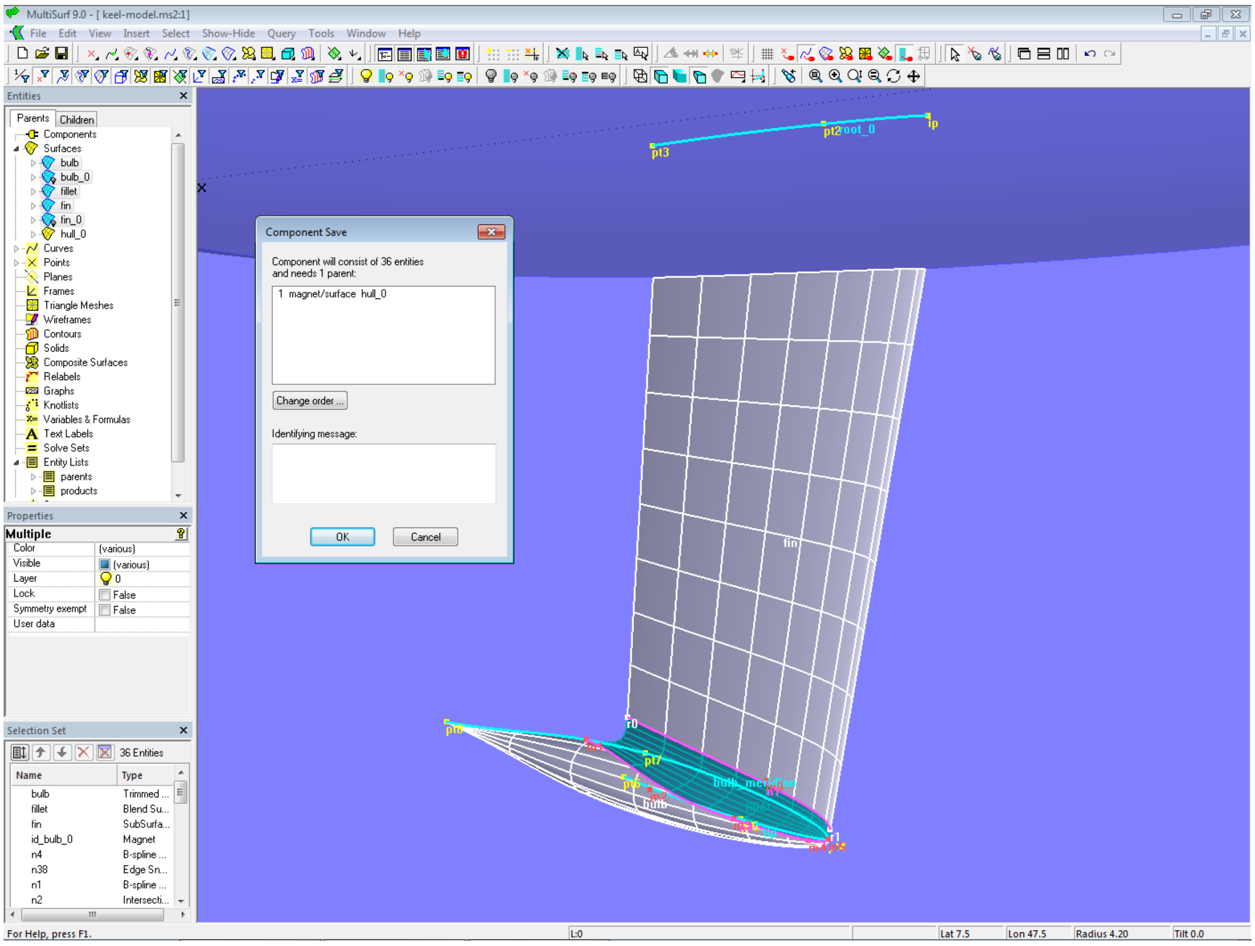


Model keel-model.ms2 – final keel surfaces in the source model

Saving the component Keel

It is useful before saving a component to show only its essential surfaces, handles and cps, but everything else is hidden. After inserting the component the work model will be clearer and the component geometry easier to change, if only that entities ultimately relevant for the shape are displayed.

With the two Entity Lists parents and products and the command **SelectForComponent** now all entities for the component geometry are selected and the result is saved via **File/ Component/ Save**. The “Component Save” dialog box will show which parents must be provided by the host model.


MultiSurf 9.0 - [keel-model.ms2:1]

Component Save

Component will consist of 36 entities
and needs 1 parent:

```
1  magnet/surface  hull_0
```

Change order ...

Identifying message:

OK   Cancel

Properties: Multiple

Color	(various)
Visible	(various)
Layer	0
Lock	False
Symmetry exempt	False
User data	

Selection Set: 36 Entities

Name	Type
bulb	Trimmed ...
fillet	Blend Su...
fin	SubSurfa...
id_bulb_0	Magnet
n4	B-spline ...
n38	Edge Sn...
n1	B-spline ...
n2	Intersecti...

For Help, press F1.   L:0   Lat 7.5   Lon 47.5   Radius 4.20   Tilt 0.0

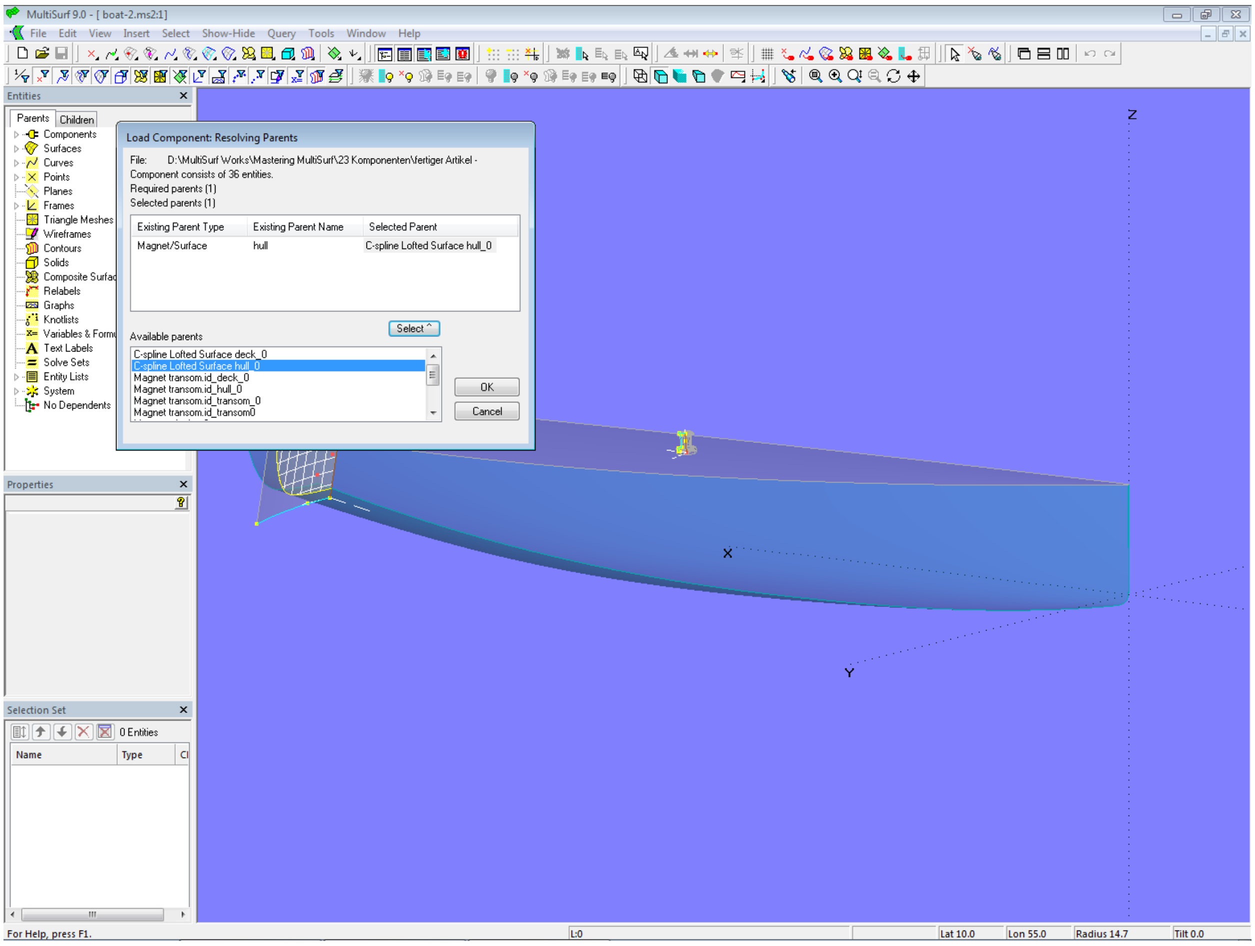
Model keel-model.ms2 - selected entity set for the keel component in the source model

Then **OK** and save the keel component using the name *keel-component.mc2*.

Loading the component Keel

Now we want to load the keel component into the *boat-2.ms2 model*, our work model. Open this model, then load the component file *keel-component.mc2* via **File/ Component/ Load** or the “Components” context menu in the Entities Manager**.**

In the "Load Component: Resolving Parents" window select the corresponding parent surface (hull_0), then **OK**.



Load Component: Resolving Parents

File: D:\MultiSurf Works\Mastering MultiSurf\23 Komponenten\fertiger Artikel -
Component consists of 36 entities.
Required parents (1)
Selected parents (1)

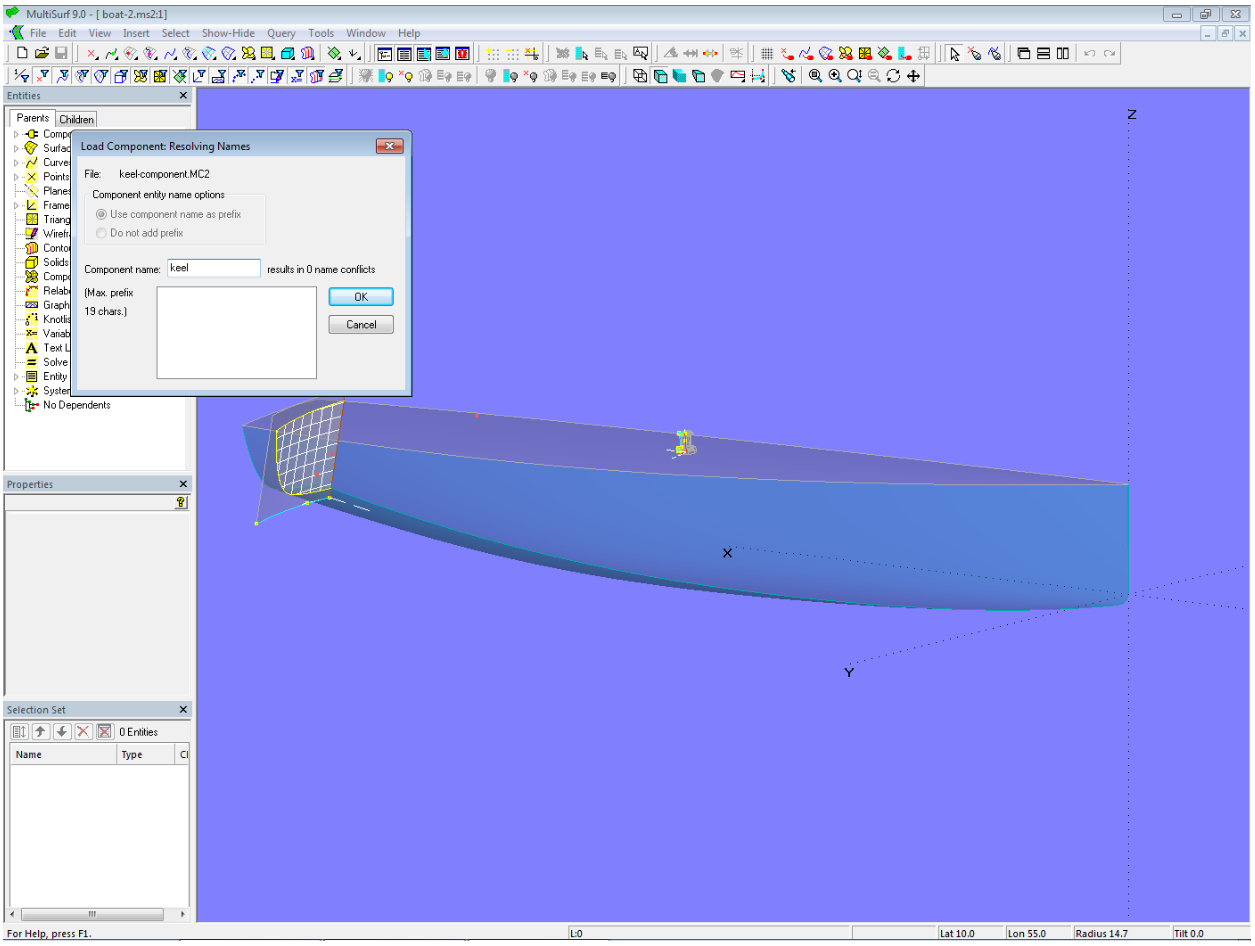
Existing Parent Type	Existing Parent Name	Selected Parent
Magnet/Surface	hull	C-spline Lofted Surface hull_0

Available parents

- C-spline Lofted Surface deck_0
- C-spline Lofted Surface hull_0
- Magnet transom.id_deck_0
- Magnet transom.id_hull_0
- Magnet transom.id_transom_0
- Magnet transom.id_transom0

Model boat-2.ms2 – selection of parent when loading the keel component into the work model

In the "Load Component: Resolving Names" window now enter the name of the component: keel. **OK** then.


MultiSurf 9.0 - [boat-2.ms2:1]
File Edit View Insert Select Show-Hide Query Tools Window Help
Entities
Parents Children
No Dependents
Properties
Selection Set
0 Entities
Name Type
Z
X
Y
OK
Cancel

Load Component: Resolving Names

File: keel-component.MC2

Component entity name options

(✓) Use component name as prefix

( ) Do not add prefix

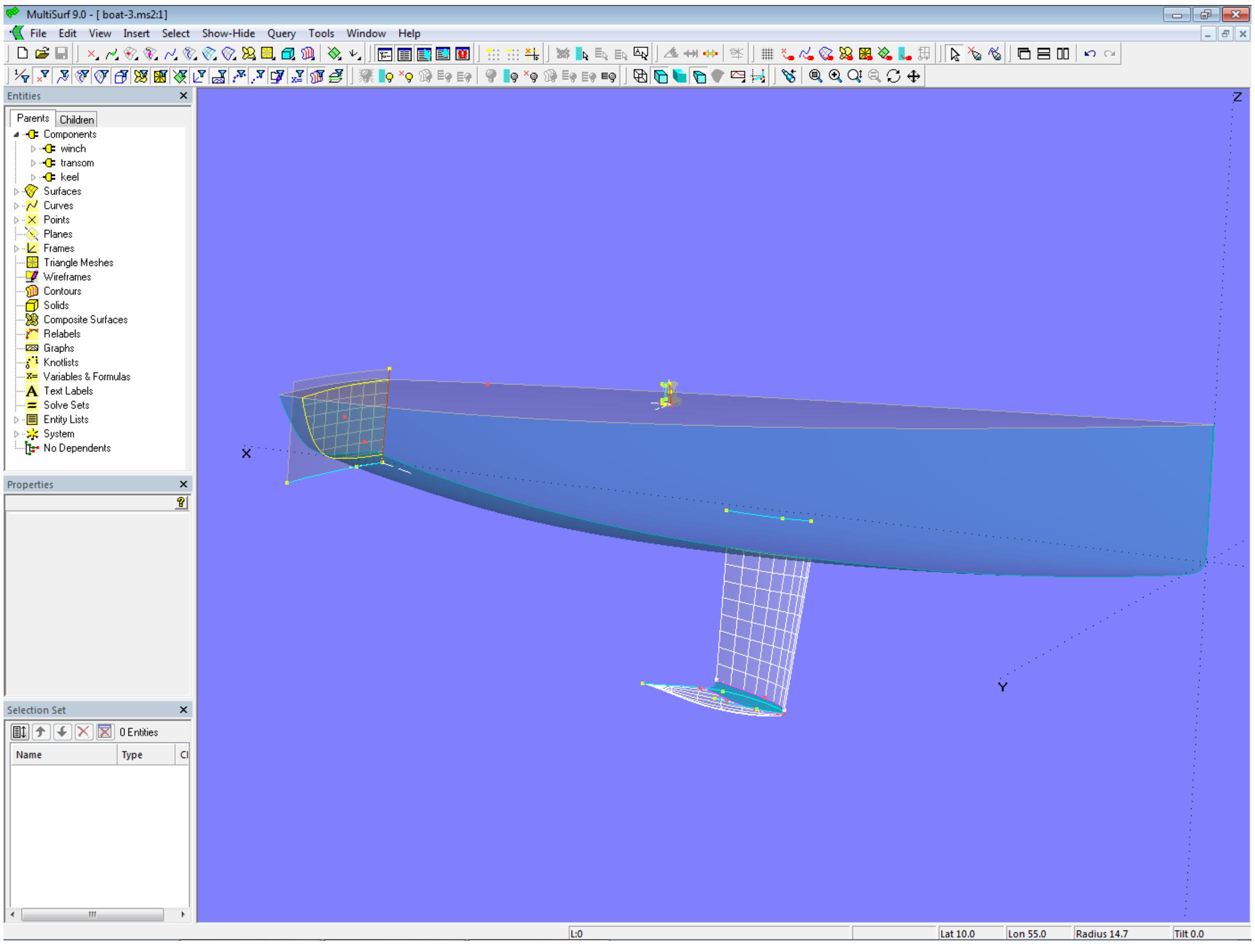
Component name: keel results in 0 name conflicts

(Max. prefix 19 chars.)

For Help, press F1. L:0 Lat 10.0 Lon 55.0 Radius 14.7 Tilt 0.0

Model boat-2.ms2 –when loading the keel component into the host model it is given the name keel

Then save the model as *boat-3.ms2*.



Model boat-3.ms2 - component keel loaded into the work model

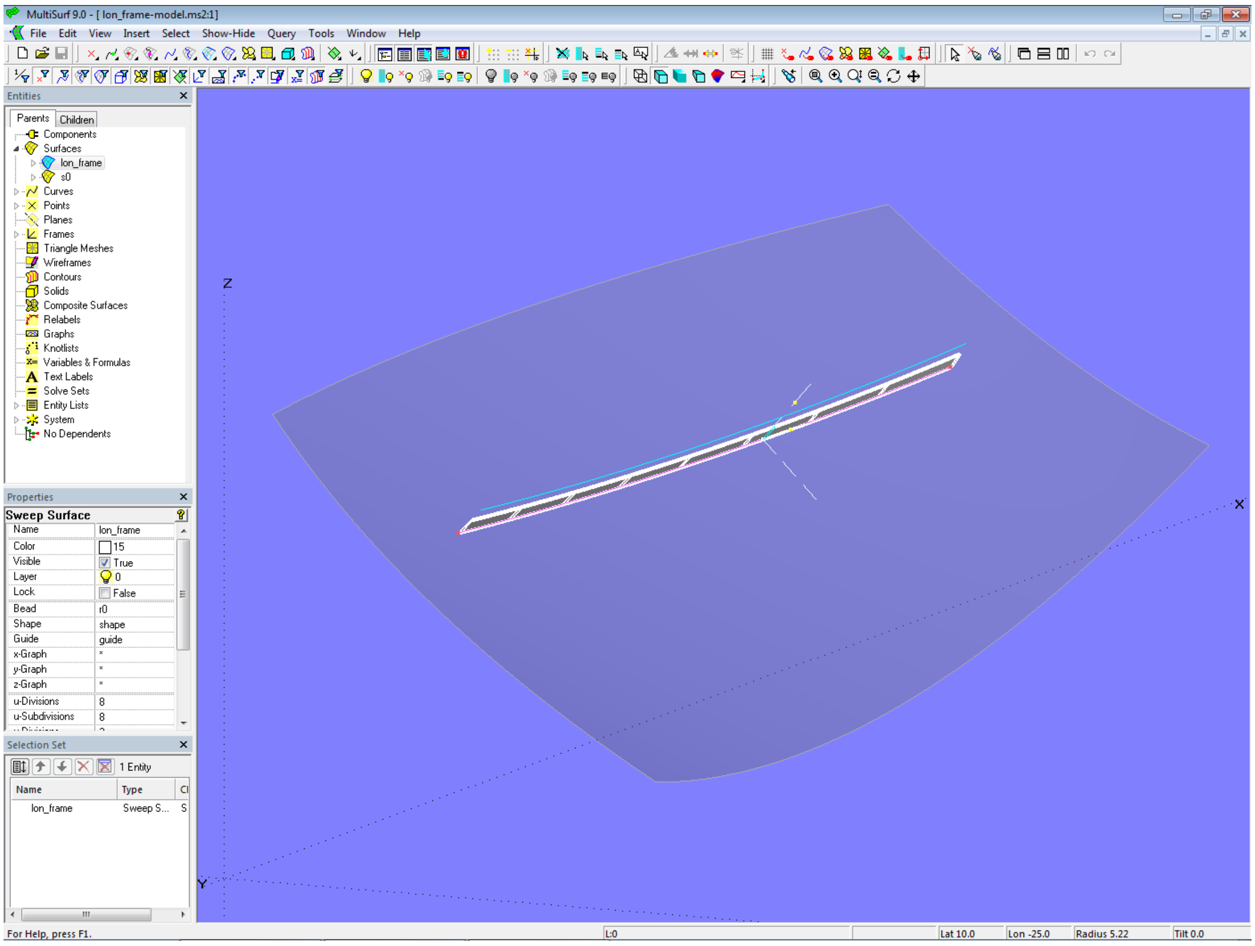
So much for the keel component.

Component Longitudinal Frame

If the plating of a metal hull is stiffened with longitudinal frames, there are typically several of them. Instead of constructing several longitudinal frames entity by entity again and again in the same way, a component saves time and work.

Source model Longitudinal Frame

The construction of a longitudinal frame is rather easy. For this let us consider the geometry model *lon_frame-model.ms2*. The surface itself is a Sweep Surface. For its construction a path is needed, a cross-sectional shape of the frame, and a curve that determines its twisting.



Sweep Surface

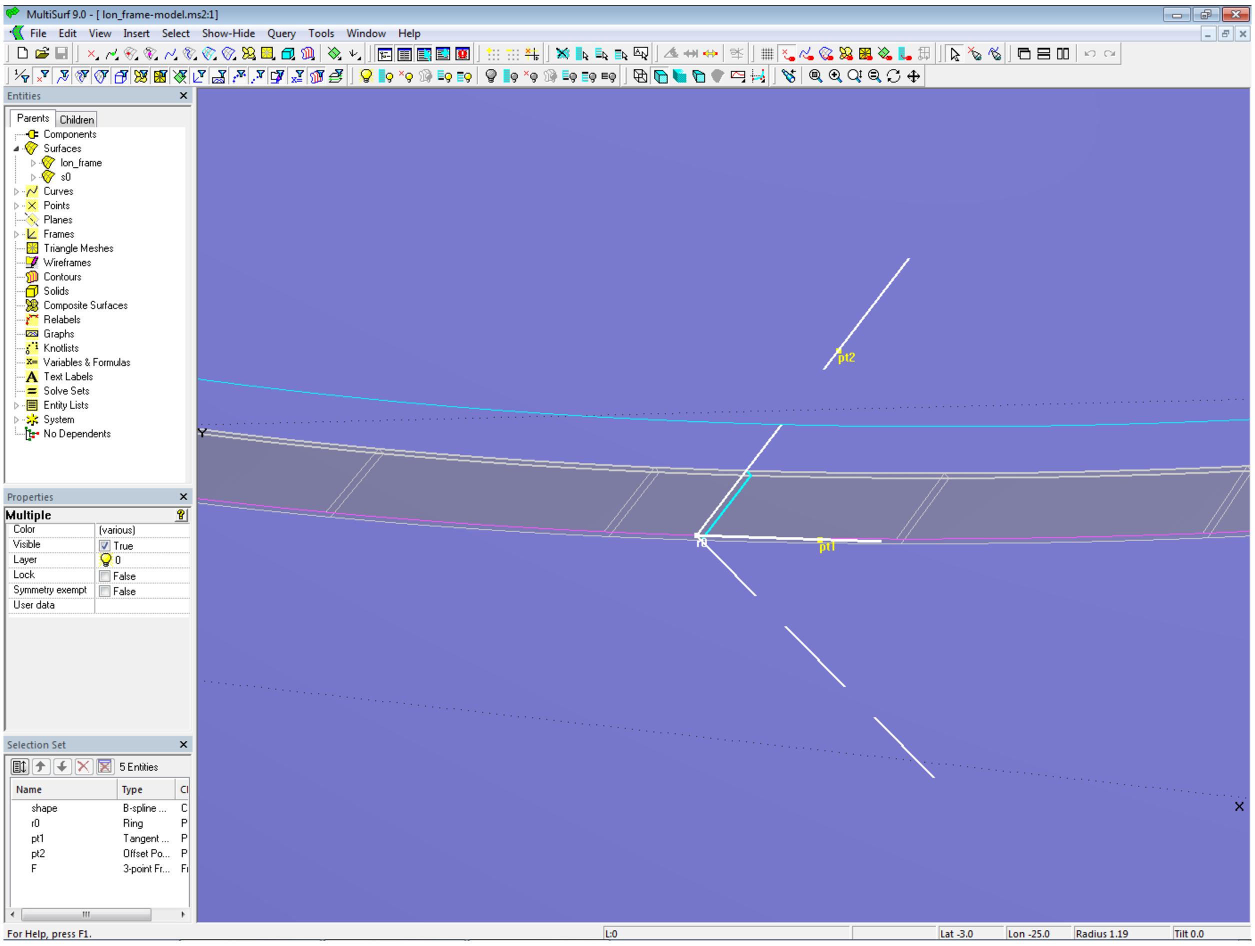
Name	lon_frame
Color	15
Visible	✓ True
Layer	0
Lock	False
Bead	r0
Shape	shape
Guide	guide
x-Graph	*
y-Graph	*
z-Graph	*
u-Divisions	8
u-Subdivisions	8

1 Entity

Name	Type	Cl
lon_frame	Sweep S...	S

Model lon_frame-model.ms2 - source model of the component for a longitudinal frame

Because the path will be the parent of the component provided by the host model, so that is why in the source model the simple Line Snake path is sufficient. First the Ring r0 is generated on the path for the longitudinal frame (path). Then the Tangent Point pt1 and the Offset Point pt2 are inserted, both dependent on r0. With these three points the 3- point Frame F is determined. In this coordinate system points are defined to control the shape of the frame cross-section represented by the B-spline curve shape (Degree = 1). Here in our example, the cross-section is a simple rectangle, but other shapes are easy to model.



Properties

Multiple

Color	(various)
Visible	✓ True
Layer	0
Lock	False
Symmetry exempt	False
User data	

Selection Set

5 Entities

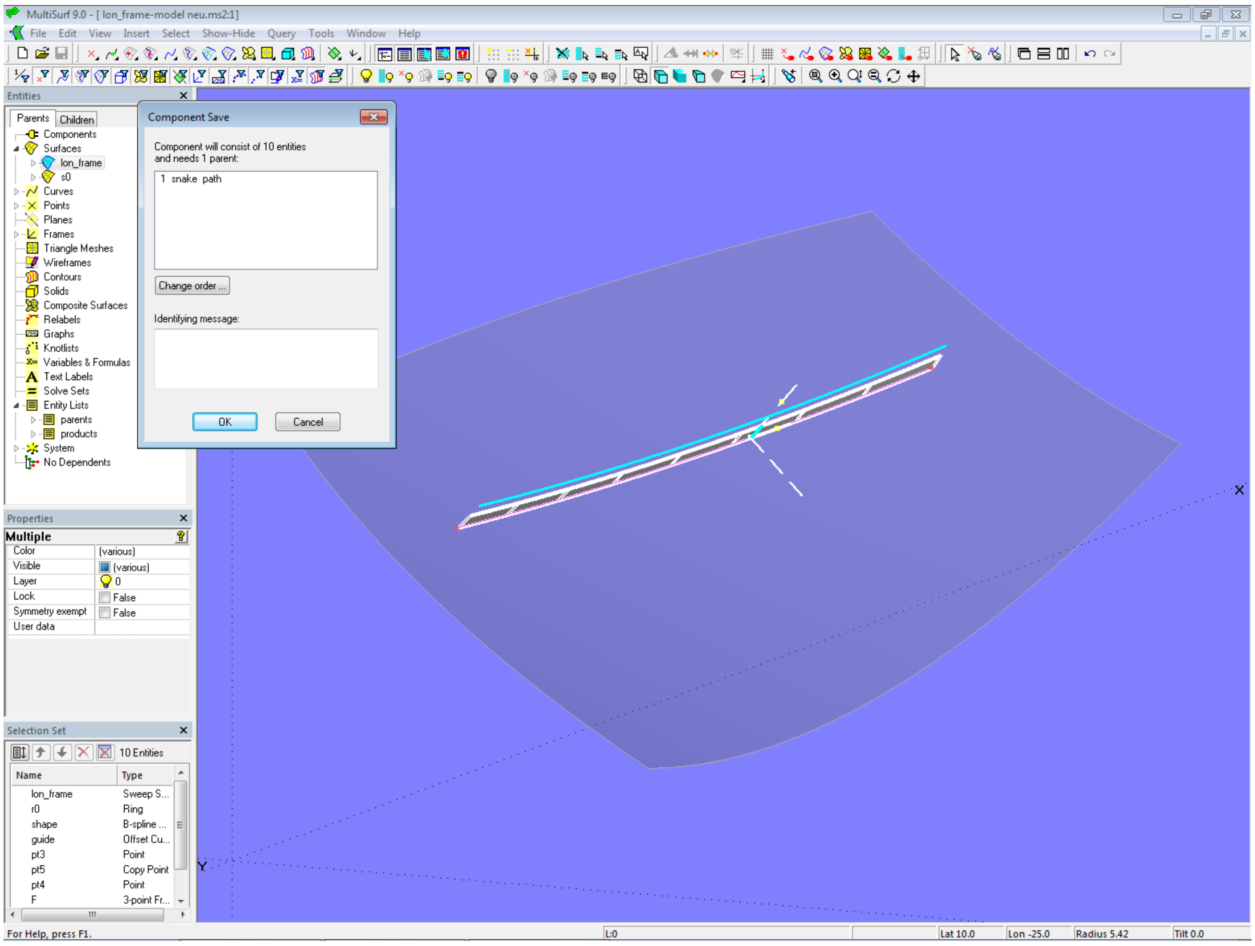
Name	Type	Cl
shape	B-spline ...	C
r0	Ring	P
pt1	Tangent ...	P
pt2	Offset Po...	P
F	3-point Fr...	Fi

Model lon_frame-model.ms2 - coordinate system for frame cross-sectione

The longitudinal frame is modeled by the Sweep Surface lon_frame. To make sure that everywhere the cross-section is perpendicular to the hull surface, the Sweep Surface uses as support the curve guide, being an Offset Curve to the Line Snake path.

Saving the component Longitudinal Frame

With the two Entity Lists parents and products and the command **SelectForComponent** now get the entity set for the component geometry, then save the result via File/ Component/ Save in the component file *lon_frame-component.mc2*.



Component will consist of 10 entities and needs 1 parent:

1 snake path

Identifying message:

Multiple

Color	(various)
Visible	(various)
Layer	0
Lock	False
Symmetry exempt	False
User data	

10 Entities

Name	Type
lon_frame	Sweep S...
r0	Ring
shape	B-spline ...
guide	Offset Cu...
pt3	Point
pt5	Copy Point
pt4	Point
F	3-point Fr...

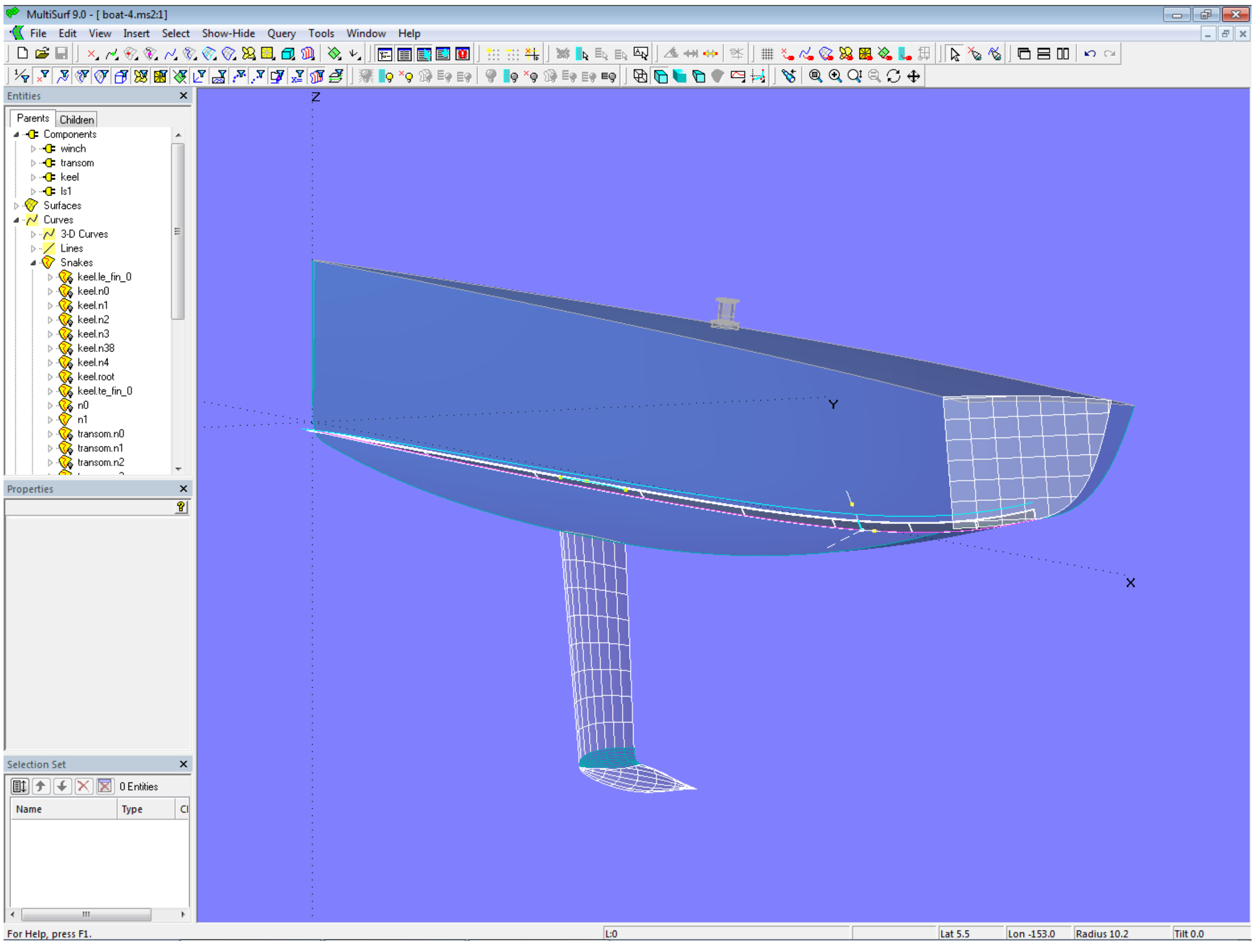
Model lon_frame-model.ms2 – saving the set of entities for the component

Loading the component Longitudinal Frame

As in the previous examples, the longitudinal frame component should now also be loaded into a work model. Let us use for this the model *boat-3.ms2.*

In this model there is for the path of the component the UVSnake n1, determined by Magnet m0. Of course this is a simple construction, with little control on the run of the path. Should the path run in a diagonal plane or a buttock plane, the hull surface must be intersected with a corresponding plane (Intersection Snake). To free-form the path, one can use a C-spline or B-spline Snake with several cps (magnets, rings). Or a C-spline Curve supported by magnets/rings is projected onto the hull surface (Projected Snake), whereby the influence of its u/v-parameter curves on the run of the snake is canceled.

The longitudinal frame component is loaded in the same way as in the preceding examples (component name: ls1). Then save the work model as *boat-4.ms2*.



Model boat-4.ms2 - longitudinal frame component ls1 inserted

The component presented can be modified easily for the construction of other components, for example, a longitudinal deck frame. To keep the cross-sections of the Sweep Surface vertical, the Offset Curve guide can be replaced by a Copy Curve.

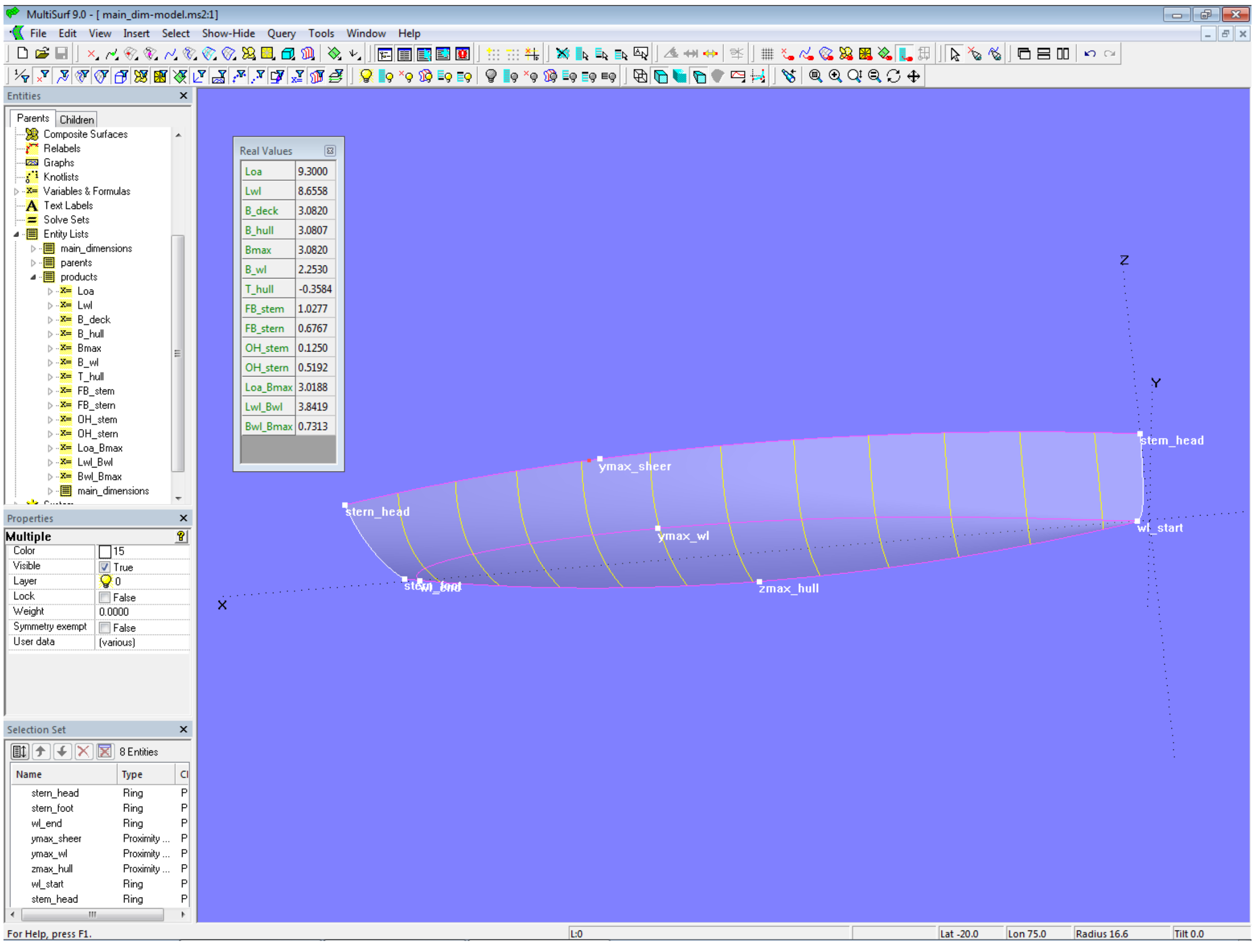
Component Main Dimensions

In tutorial 14, *"How to Create Computing MultiSurf Models"*, the model *main_dimensions.ms2* is discussed. The model determines the main dimensions of a boat hull. With the help of a component, the calculation methods can be inserted into other models.

Main Dimensions – source model

The basic model for this component is model *main_dim-model.ms2*. The necessary formulas use essentially the functions XPOS, YPOS and ZPOS in order to determine the XYZ coordinates of points. With these coordinates distances are calculated, for example, length over all, waterline length, front and rear overhang, etc.

Maximum deck width and beam of waterline are found with the help of Proximity Rings. This entity automatically finds the point on a curve that has the greatest distance from a plane (here midship plane).



Real Values

Loa	9.3000
Lwl	8.6558
B_deck	3.0820
B_hull	3.0807
Bmax	3.0820
B_wl	2.2530
T_hull	-0.3584
FB_stem	1.0277
FB_stern	0.6767
OH_stem	0.1250
OH_stern	0.5192
Loa_Bmax	3.0188
Lwl_Bwl	3.8419
Bwl_Bmax	0.7313

Properties

Multiple

Color	15
Visible	True
Layer	0
Lock	False
Weight	0.0000
Symmetry exempt	False
User data	(various)

Selection Set

8 Entities

Name	Type	Cl
stern_head	Ring	P
stern_foot	Ring	P
wl_end	Ring	P
ymax_sheer	Proximity ...	P
ymax_wl	Proximity ...	P
zmax_hull	Proximity ...	P
wl_start	Ring	P
stem_head	Ring	P

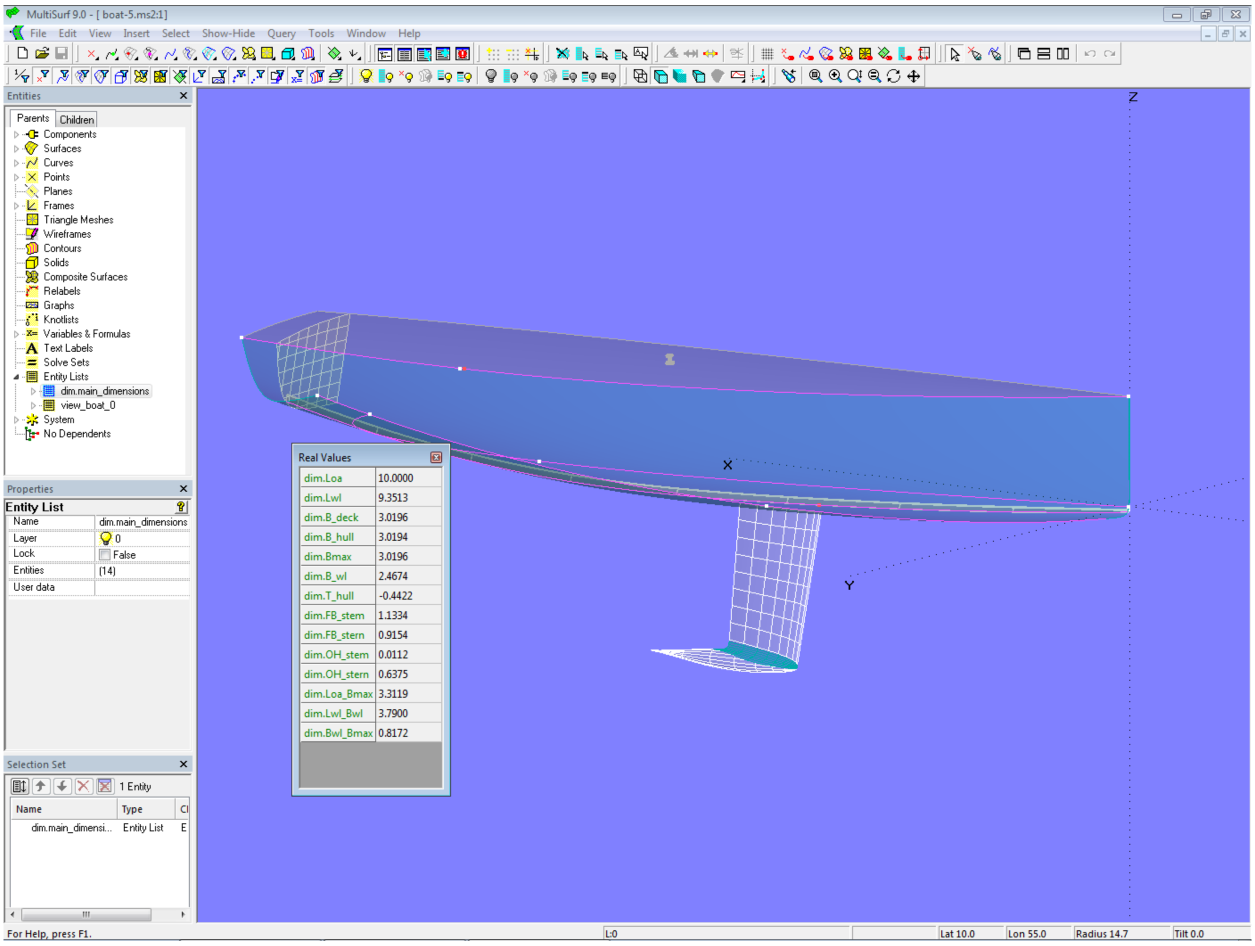
Model main_dimensions.ms2

Saving the component Main Dimensions

Entity List parents holds the boat surface hull, while Entity List products contains all formulas needed for the calculation of the main dimensions. As with the components already described, all required entities for the component geometry can be easily selected with these two Entity Lists and the command **SelectFor-Component**. Then save the result via **File/ Component/ Save** (filename *main_dim-component.mc2*).

Loading the component Main Dimensions

Open the model *boat-4.ms2* as work model and add the component *main_dim-component.mc2* via **File/ Component/ Load** or the “Components” context menu. The component requires as parent just a surface, to do this, select hull_0 accordingly. Component name: dim. Finally save the model file as *boat-5.ms2*.



Entity List

Name	dim.main_dimensions
Layer	0
Lock	False
Entities	(14)
User data	

Name	Type	Cl
dim.main_dimensi...	Entity List	E

Real Values

dim.Loa	10.0000
dim.Lwl	9.3513
dim.B_deck	3.0196
dim.B_hull	3.0194
dim.Bmax	3.0196
dim.B_wl	2.4674
dim.T_hull	-0.4422
dim.FB_stem	1.1334
dim.FB_stern	0.9154
dim.OH_stem	0.0112
dim.OH_stern	0.6375
dim.Loa_Bmax	3.3119
dim.Lwl_Bwl	3.7900
dim.Bwl_Bmax	0.8172

Model boat-5.ms2 – component dim for calculation of the main dimensions added

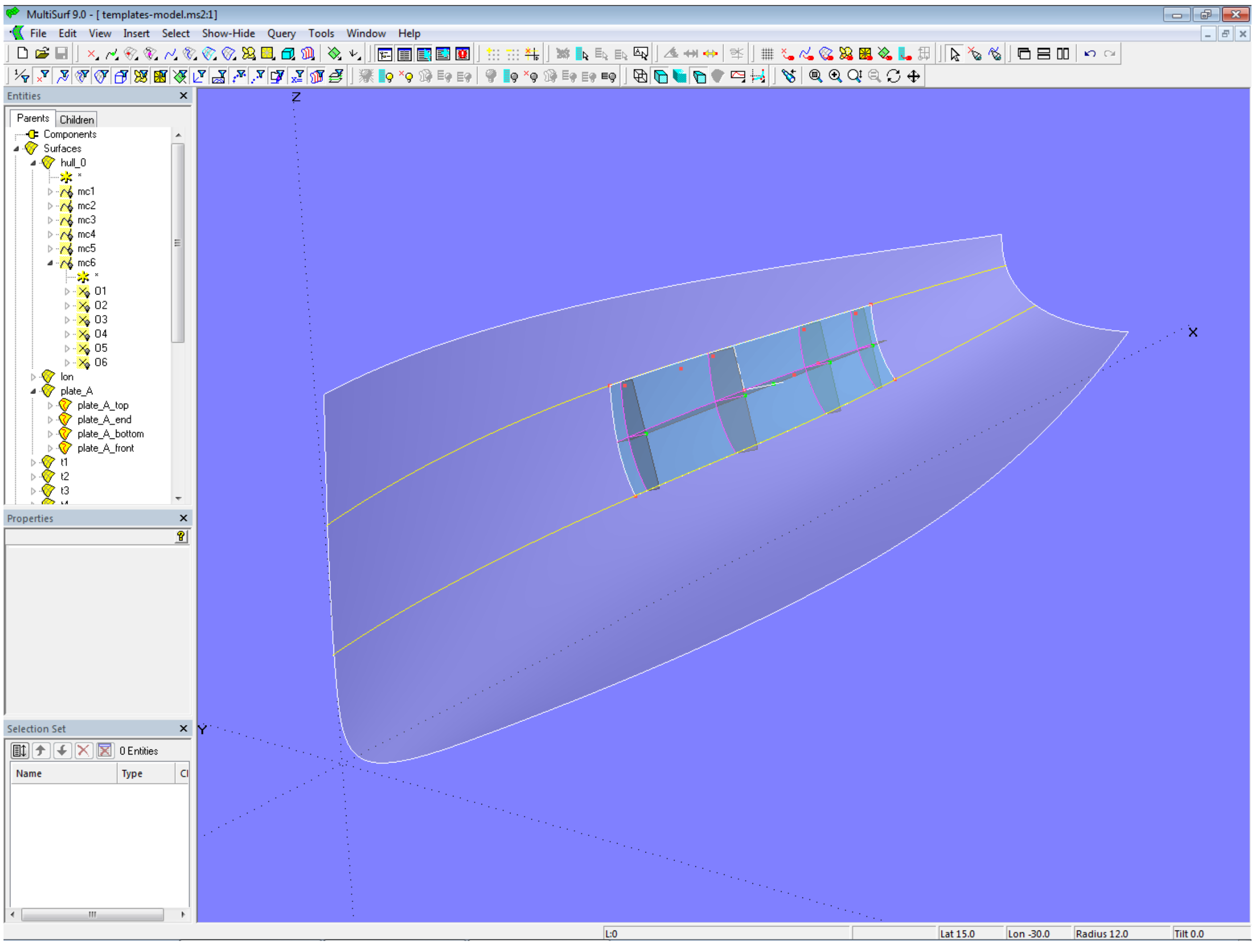
The numerical values of Variable and Formula entities can be displayed in MultiSurf via **Tools/ Real Values** (main menu), or simply press the **V** key as short-cut. To avoid that the values of all formulas and variables in a model are displayed, it is advisable to add only the desired values into an Entity List. Select it in the Entities Manager, then **V**. The inserted component contains the Entity List dim.main_dimensions.

Templates for hull plate forming

When building metal boats and ships, the outer shell consists of a set of plates. In the case of a round-bilge hull shape, plates are curved in all directions and must be brought into their 3-dimensional shape by a forming process. To control the forming, templates for the hull shape in the area of a plate are helpful. With a component, these templates can be created for each single plate with little effort. Let us consider the model *templates-model.ms2*.

Templates source model

Model *templates-model.ms2* includes the hull surface hull_0. By 4 edge curves (Snakes) the SubSurface plate_A is created. For this area there are 4 templates in the transverse direction and one template in the longitudinal direction.

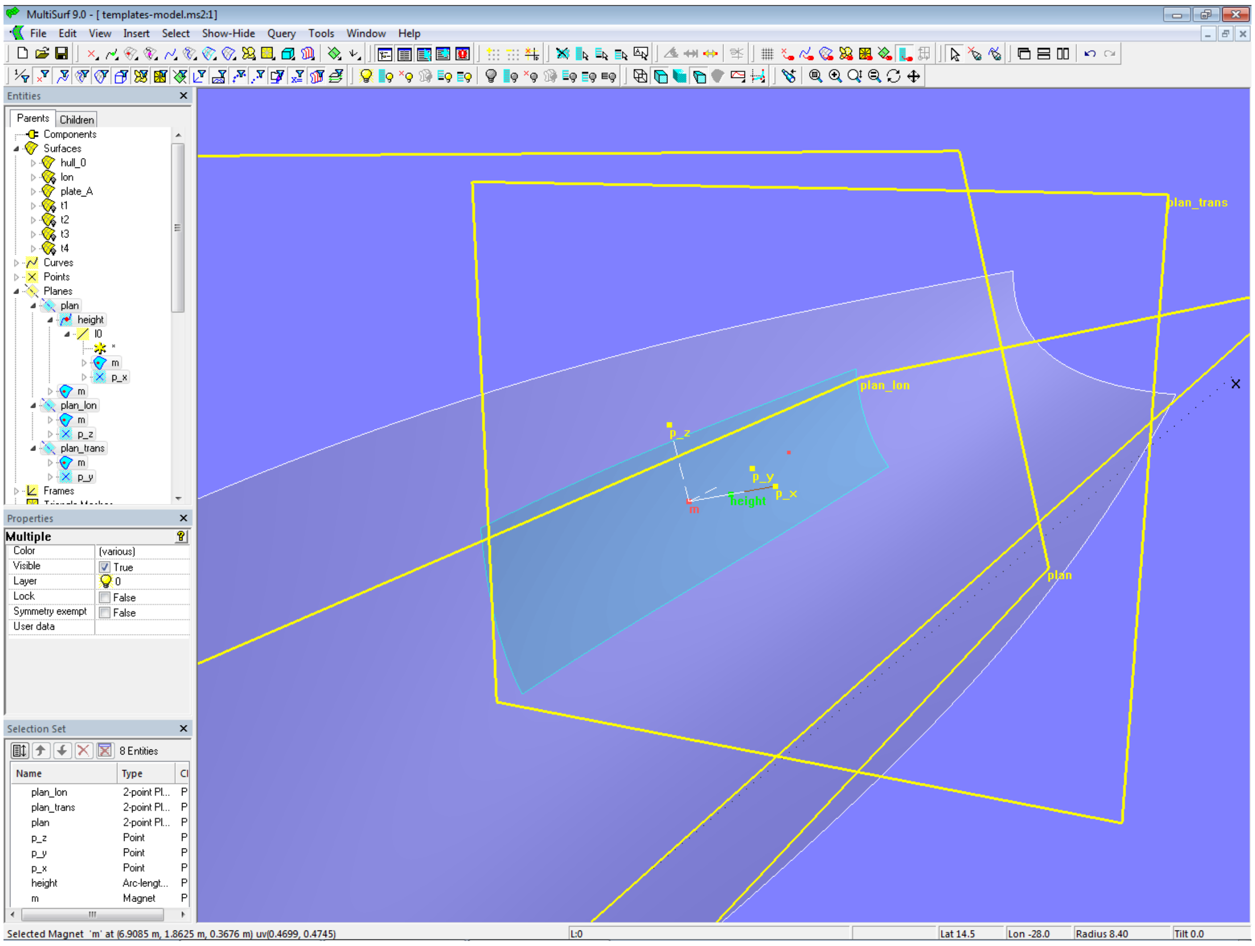


Model templates-model.ms2 – source model for templates to control the forming process of shell plating

The transverse templates are at right angles to the lengthwise template, their back edges are in a common plane. Placed on a flat ground, the free template edges describe the shape of the SubSurface plate_A.

The starting point of the construction is Magnet m on plate_A. On it depends the Offset Point p_off and the Magnet m_rot which is relative to m. With these 3 points the 3-point Frame F is defined. Point p_x lies on the X-axis of F, Point p_y on the Y-axis, and Point p_z on the Z axis. There is also Line l0 between Magnet m and Point p_x. Line l0 is support for the Arc-length Bead height, with which the height of the templates is determined.

With p_x, p_y, p_z and the Magnet m 3 planes are created as 2-point Plane entities: plan_lon perpendicular to the Z-axis of frame F, plan_trans perpendicular to its Y-axis, and plan perpendicular to its X-axis.



Properties

Multiple

Color	(various)
Visible	✓ True
Layer	0
Lock	False
Symmetry exempt	False
User data	

Selection Set

8 Entities

Name	Type	Cl
plan_lon	2-point Pl...	P
plan_trans	2-point Pl...	P
plan	2-point Pl...	P
p_z	Point	P
p_y	Point	P
p_x	Point	P
height	Arc-lengt...	P
m	Magnet	P

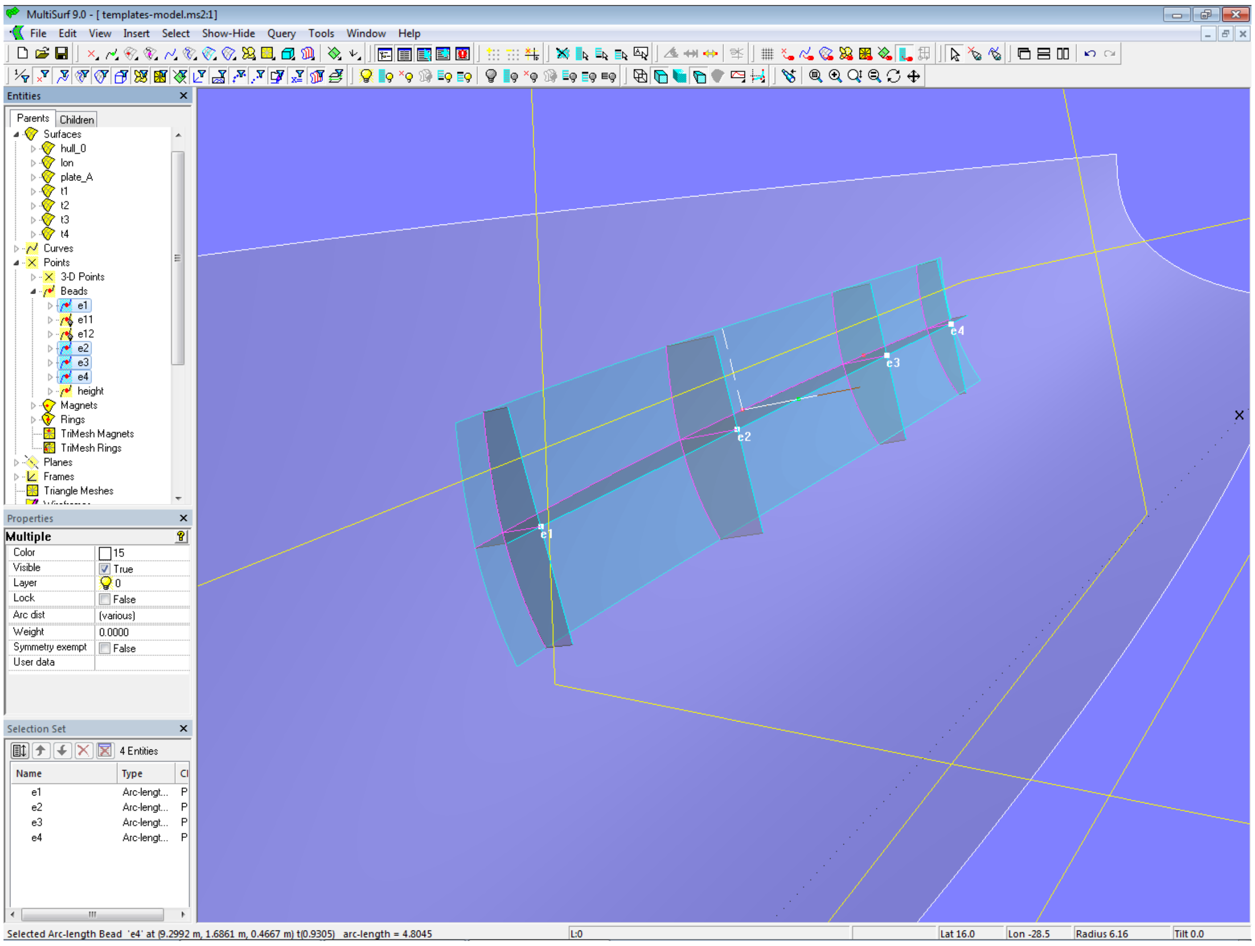
Selected Magnet 'm' at (6.9085 m, 1.8625 m, 0.3676 m) uv(0.4699, 0.4745) L:0 Lat 14.5 Lon -28.0 Radius 8.40 Tilt 0.0

Model templates-model.ms2 - projection and section planes for longitudinal and transverse templates

The 2-point Plane plan_lon now cuts plate_A in the longitudinal direction in the Intersection Snake n_lon. This in turn is projected onto the 2-point Plane plan as Projected Curve proj_lon on which the 4 Arc-length Beads e1, e2, e3 and e4 are situated. At their positions plate_A is now cut by the 2-point Plane plan_trans in the Intersection Snakes n1_trans, n2_trans, n3_trans and n4_trans. They are also projected onto plan.

These intersection snakes and their projections are then used to create the longitudinal template and the 4 cross templates as Ruled Surfaces (t1, t2, t3, t4, lon).

The templates can be easily adapted to the respective conditions of the shell plate for which they are intended. With Magnets m and m_rot the longitudinal template can be moved and rotated so that it runs nearly in the middle of the plate. With beads e1, e2, e3 and e4 the transverse templates can be distribut-ed lengthwise, the Arc-length Bead height adjusts the height of the templates.



Properties

Multiple

Color	15
Visible	True
Layer	0
Lock	False
Arc dist	(various)
Weight	0.0000
Symmetry exempt	False
User data	

Selection Set

4 Entities

Name	Type	Cl
e1	Arc-lengt...	P
e2	Arc-lengt...	P
e3	Arc-lengt...	P
e4	Arc-lengt...	P

```
Selected Arc-length Bead  'e4' at (9.2992 m, 1.6861 m, 0.4667 m) t(0.9305)   arc-length = 4.8045    L:0    Lat 16.0   Lon -28.5   Radius 6.16   Tilt 0.0
```

Model templates-model.ms2 - source model for templates for the control of the forming of hull shell panels

So much for the construction of the source model for the template component.

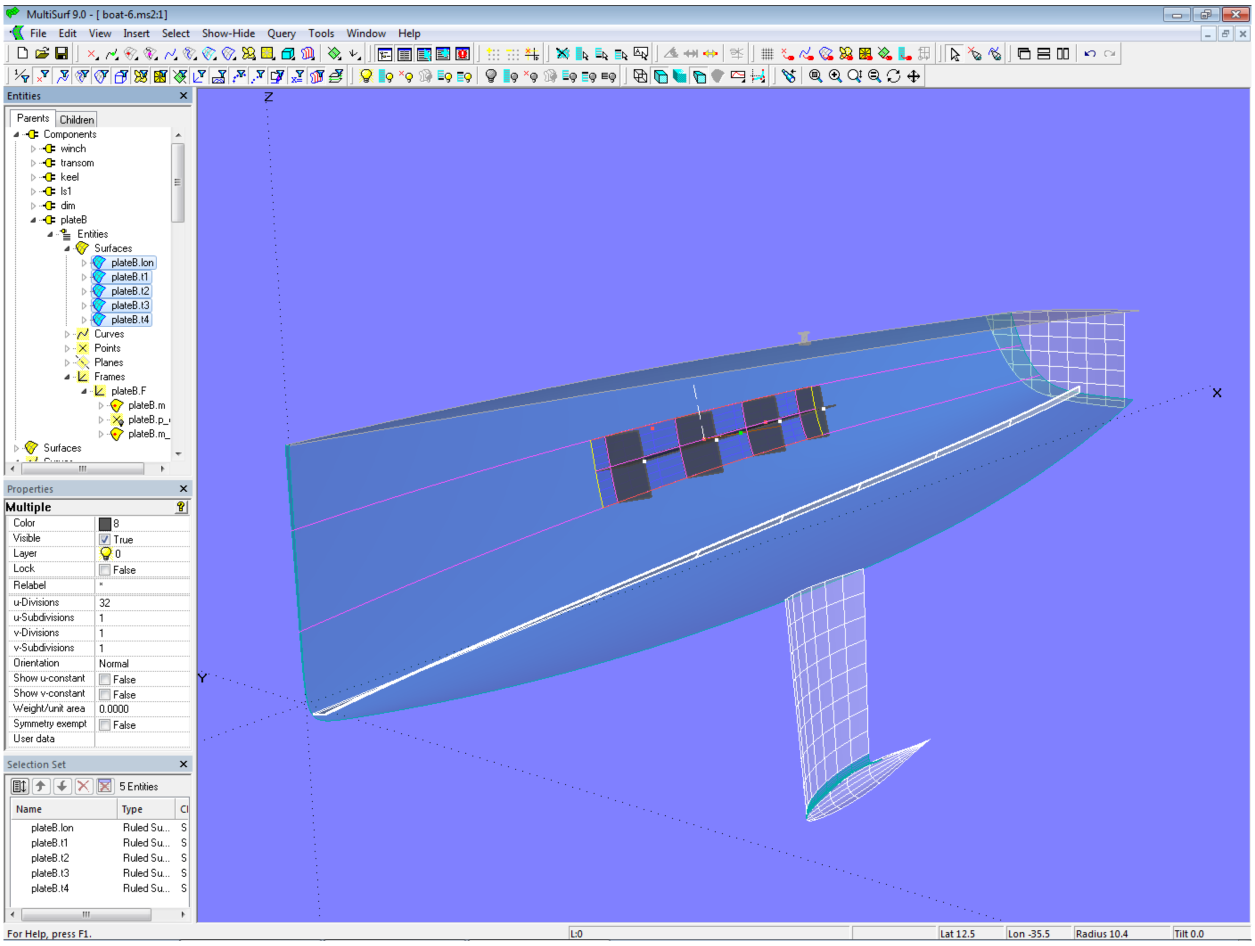
Saving the component Templates

It is useful before saving a component to show only its essential surfaces, handles and cps, but everything else is hidden. After inserting the component the work model will be clearer and the component geometry easier to change, if only that entities ultimately relevant for the shape are displayed.

Entity List parents only holds the SubSurface plate_A, while Entity List products contains the 5 template surfaces. With both Entity Lists and the command **SelectForComponent** the component entities set is selected and then saved via **File/ Component/ Save** (filename *templates-component.mc2*). The source model *templates-model.ms2* can now be closed.

Loading the component Templates

Now let us add the component to the model *boat-5.ms2*, which will serve as our host model. So open this model, show the SubSurface plate_B and select it. Then **File/ Component/ Load** or “Components” context menu; as component name choose plateB. The names of all the inserted entities will get this string as prefix and you can identify to which plate the templates belong to. Finally save the model under the filename *boat-6.ms2*.



Properties

Multiple

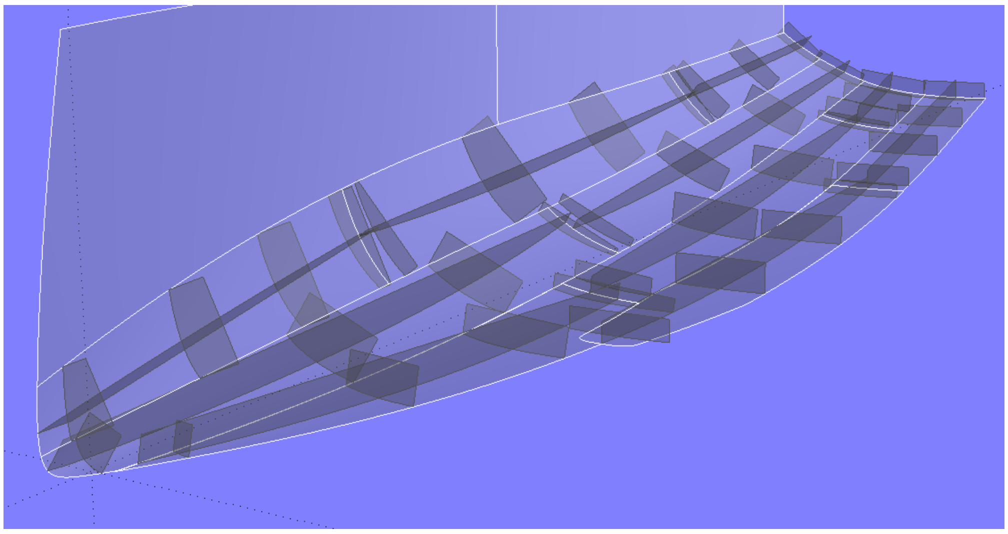
Color	8
Visible	✓ True
Layer	0
Lock	False
Relabel	*
u-Divisions	32
u-Subdivisions	1
v-Divisions	1
v-Subdivisions	1
Orientation	Normal
Show u-constant	False
Show v-constant	False
Weight/unit area	0.0000
Symmetry exempt	False
User data	

Selection Set

5 Entities

Name	Type	Cl
plateB.lon	Ruled Su...	S
plateB.t1	Ruled Su...	S
plateB.t2	Ruled Su...	S
plateB.t3	Ruled Su...	S
plateB.t4	Ruled Su...	S

Model boat-6.ms2 - component plateB for plate templates added



Application of the template component – 13 m sailing yacht

Possible component problems

A component is a piece from a MultiSurf model. Its dependencies are usually incomplete; it needs parents from the host model (working model) into which it is inserted. This is why source model and host model should match in the following ways:

- Similarity of parents
- same normal direction for surfaces
- same u/v-parameter direction for surfaces
- same t-parameter direction for curves and snakes

If there are differences, errors can occur when loading a component. In general, however, they are easy to fix.

Similarity of source and host parents

The parents of the host model must match those in the source model. For example, if in the source model the component is a C-spline Lofted Surface with 3 master curve parents, in the host model the parents for the component must be 3 entities that qualify as curves (curve, snake, point).

Same normal direction for surfaces

In model *boat-1.ms2* the normal orientation of the deck surface (deck_0) is upwards. The winch is on the deck. Would deck_0 be oriented inside, the winch would be upside down. That is easy to correct in that the value for "Offset" of winch.p5 is given an opposite sign. Though you could also use the Entities Manager to set the "Orientation" property of deck_0 from “Normal” to “Reverse”, you should refrain from doing this because other entities could be affected. If you only edit the component, the effect remains limited to its entities.

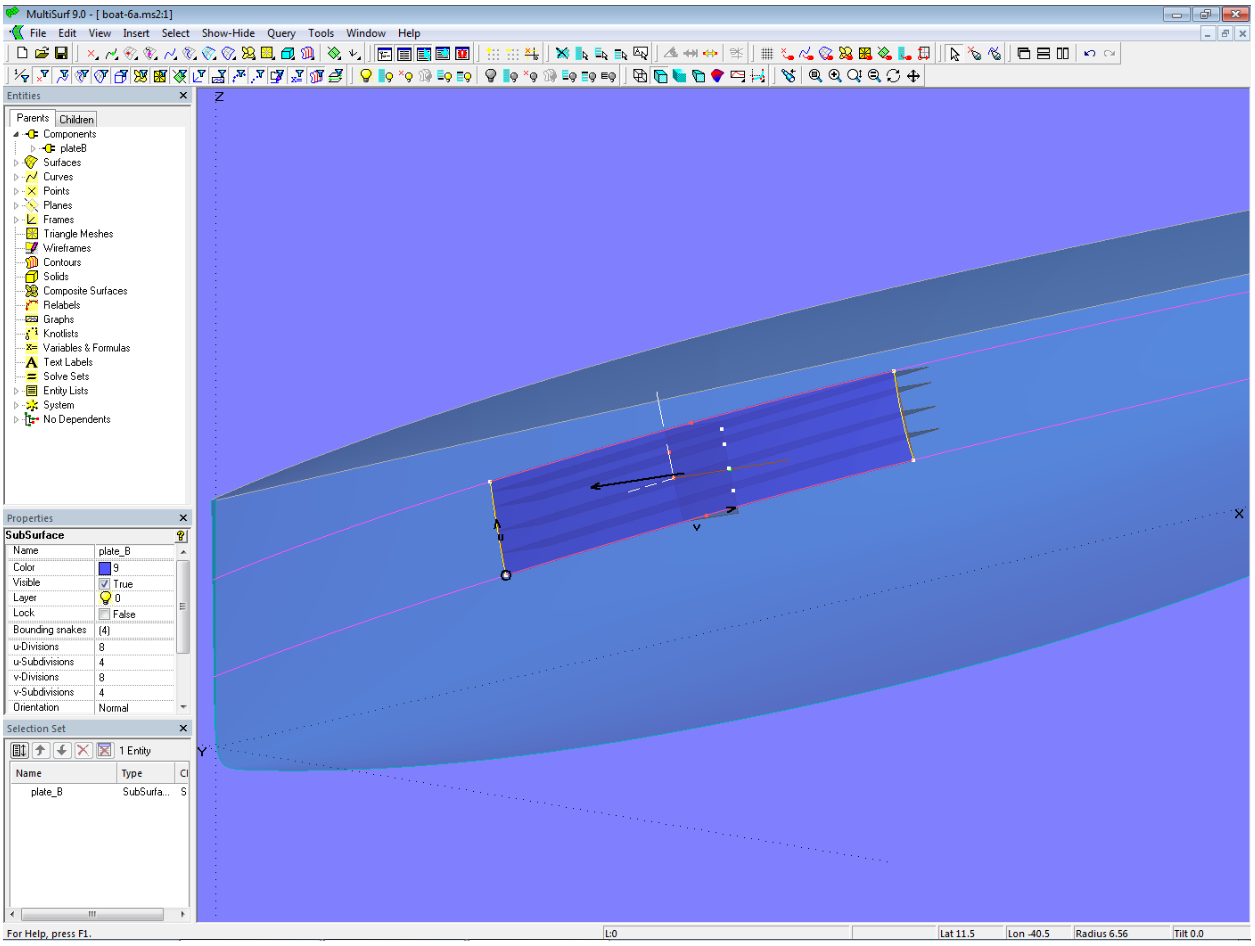
Same u/v-parameter direction for surfaces

Let us consider the example *boat-6a.ms2* into which the template component is loaded. In contrast to the model *boat-6.ms2*, the u-parameter direction runs in the transverse direction of SubSurface plate_B. Correspondingly, the templates are twisted.

With Magnet plateB.m_rot they can simply be turned around into the desired direction.

Difference in size between component source model and host model

This is the case, for example, with the transom component described above. It was saved from the model for a smaller boat and then was loaded into a model for a longer boat.



SubSurface	
Name	plate_B
Color	9
Visible	True
Layer	0
Lock	False
Bounding snakes	(4)
u-Divisions	8
u-Subdivisions	4
v-Divisions	8
v-Subdivisions	4
Orientation	Normal

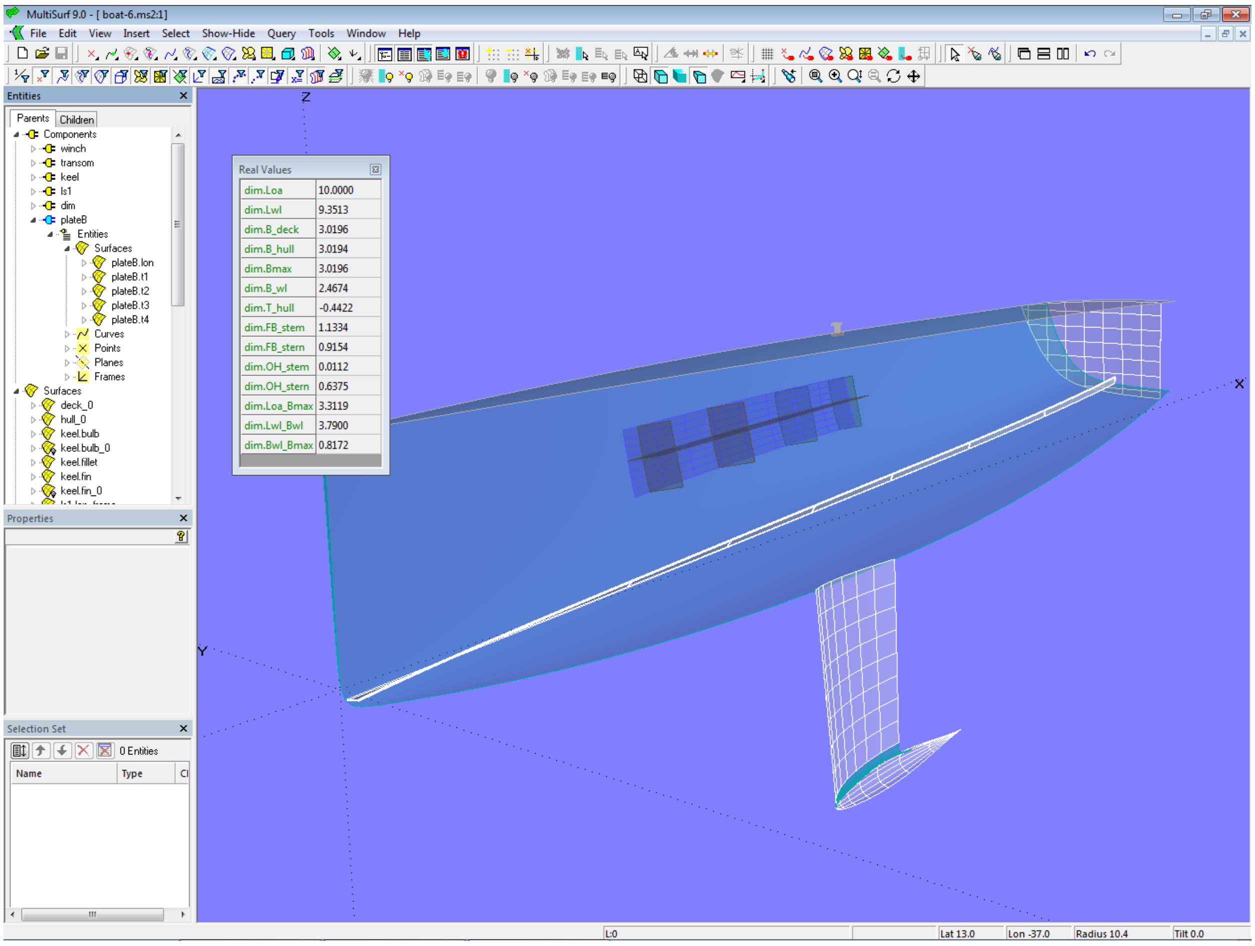
Name	Type	Cl
plate_B	SubSurfa...	S

Model boat-6a.ms2

Modifying a component file

When MultiSurf saves a component file (* *.mc2*), all parents of the component from the source model are included as hidden entities. That is why a component file (* *.mc2*) can also be opened independently in MultiSurf. From main menu select **File/ Open**, and then in the “Open”-dialog window choose in the input field at the bottom right “All files (*.*)".Now the selection window will list not only standard model files (* *.ms2*), but also component files (* *.mc2*).

In this way you can edit a component file in the same way as a normal model. You can then save it as a model file (*.ms2*), or create a modified component (*.mc2*).



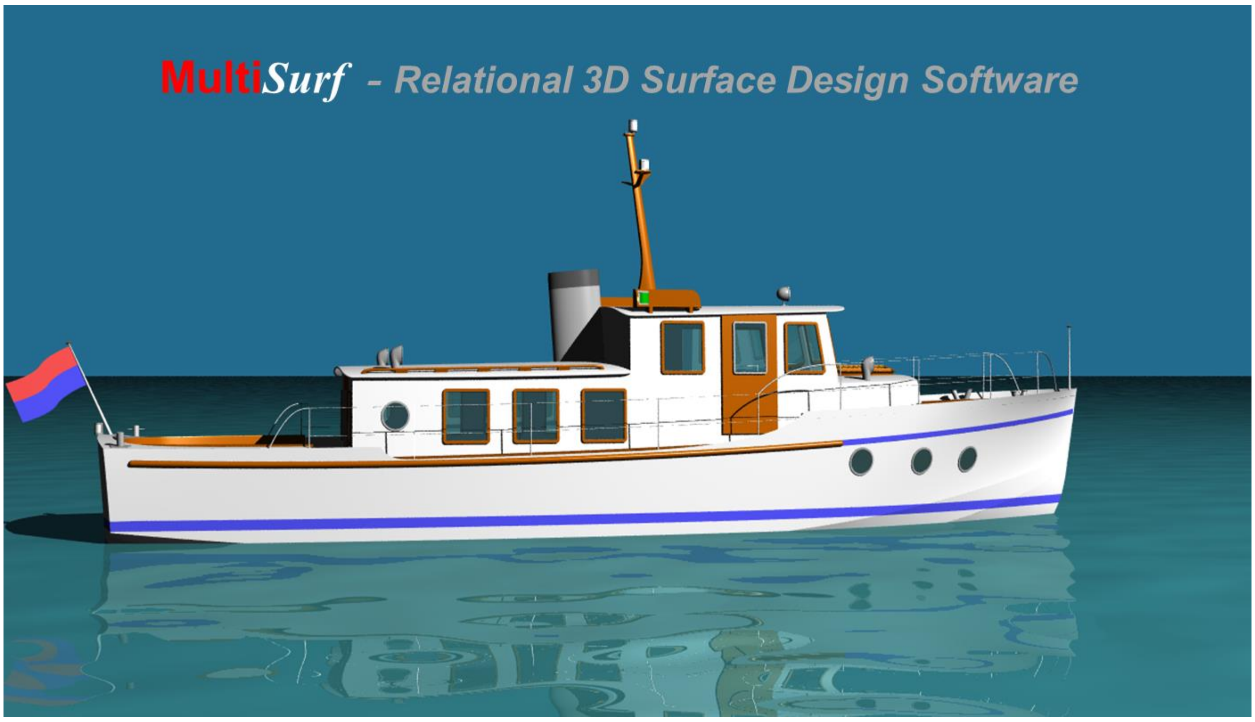
Real Values

dim.Loa	10.0000
dim.Lwl	9.3513
dim.B_deck	3.0196
dim.B_hull	3.0194
dim.Bmax	3.0196
dim.B_wl	2.4674
dim.T_hull	-0.4422
dim.FB_stem	1.1334
dim.FB_stern	0.9154
dim.OH_stem	0.0112
dim.OH_stern	0.6375
dim.Loa_Bmax	3.3119
dim.Lwl_Bwl	3.7900
dim.Bwl_Bmax	0.8172

Model boat-6.ms2 – example model with 6 components added

So much for part 1 of the tutorial about models for components, storing components and loading components into other models.

Part 2 of the tutorial will introduce a number of components for equipment details to give a boat or ship a more realistic appearance in Render View.


MultiSurf - Relational 3D Surface Design Software

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