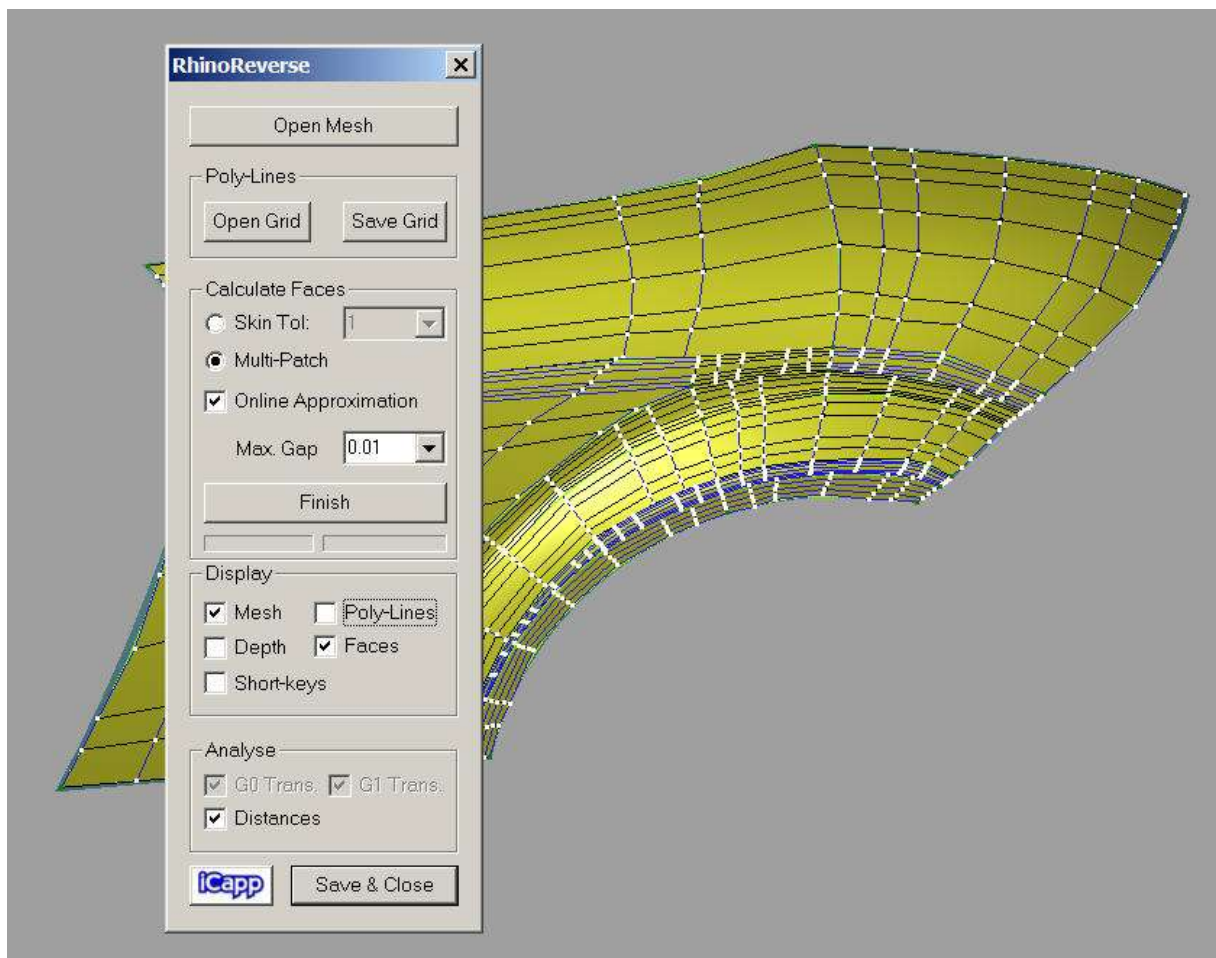


RhinoReverse™

Tutorial



RhinoReverse™ V1.1

21. August 2006

RhinoReverse™ is plug-in software for the CAD-system Rhinoceros® (www.rhino3d.com). The purpose is to create spline-faces based on a given mesh of point data. The user interactions have been reduced on sketching the boundaries for the new faces. All calculations for approximation and tangency transitions will be done automatically. This leads to a very simple and intuitive handling of the software. One big advantage is the option to represent large complex shapes by only a few faces.

Different interfaces to read point data are available:

Input: *.stl, *.pol, *.wrl, *.vrml, *.af, *.nas, *.txt

RhinoReverse™ is easy to use and it is a cost saving alternative to other reverse engineering solutions. **RhinoReverse™** is a product of iCapp GmbH.

The current tutorial shall enable the user within a few minutes to start working with the plug-in.

Release notes for version 1.1:

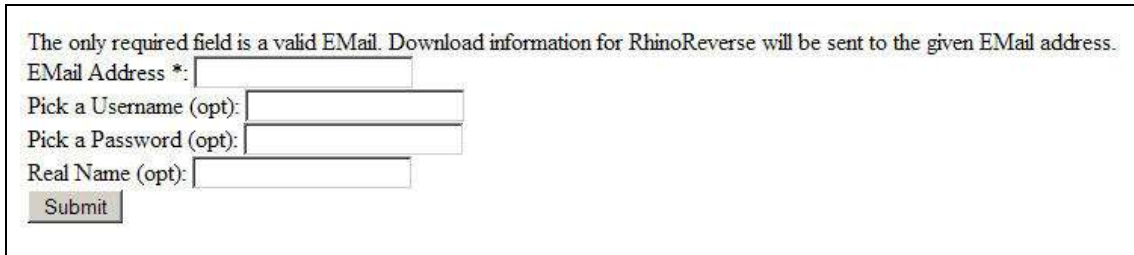
- Acceleration of the calculation speed for the finish operation (~factor 5)
- Faster interactive sketching of face boundaries by the reduction of online calculation time
- User defined value for G0-tolerance at face transitions ("Max. Gap.")
- Improvement of depth depending graphical displaying (for tubes etc.)

iCapp GmbH
Technoparkstrasse 1
8005 Zürich

www.rhinoreverse.icapp.ch
RhinoReverse@icapp.ch

Installation

1. Make sure, that Rhinoceros® is already installed on your computer.
2. Download the installation version of RhinoReverse from the web-site www.rhinoreverse.icapp.ch. A request window will appear:



The only required field is a valid EMail. Download information for RhinoReverse will be sent to the given EMail address.

E-Mail Address *:

Pick a Username (opt):

Pick a Password (opt):

Real Name (opt):

Submit

Web-site request window

3. Please enter in minimum your valid email address. The download location will be send to the entered email address:



Please download RhinoReverse.zip at
http://www.icapp.ch/iCapp-Daten/http-Download/1B3_RhinoReverse.zip
for further Information visit <http://rhinoreverse.icapp.ch/>

Download location

4. Click on the given link and save the RhinoReverse™-zip-file to the c-partition (hard disk) of the coumputer, where you want to install the software.

Attention: *The installation can fail, if the installation files have been stored on any other disk and you try to install via network link!*

5. Unzip the file and run Setup.exe. The installation will be done automatically. Please follow the installation process.

Face generation with RhinoReverse™

The faces will be created in 5 steps:

1. Start Rhinoceros®
2. Start RhinoReverse™
3. Read mesh data
4. Define face boundaries by sketching poly lines
5. Calculate faces

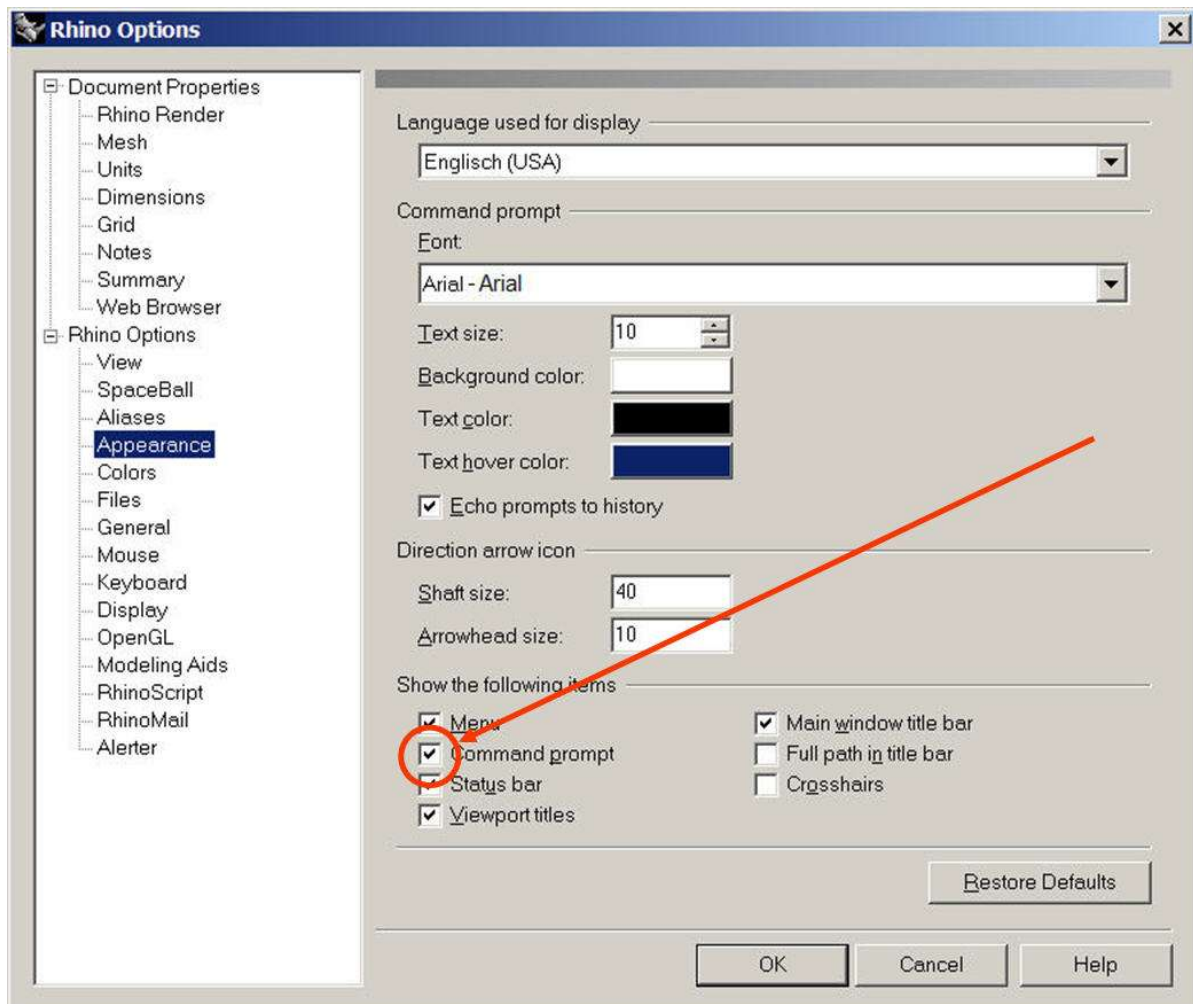
The meaning of “poly lines” is, to divide the mesh surface like a grid. Every cell of the grid, which is completely bounded by four poly lines, will be approximated automatically by one spline-face. To store this kind of information we use a so called “Grid-file”.

Attention: Don't forget step 4, the face calculation. The automatically created faces when sketching poly lines are only start faces. No tangency transitions are checked in this state.

1 Start Rhinoceros®

Start Rhino by using the start menu of your windows system. Make sure, that the command prompt is active:

- a. Click on the menu entry **Tools/Options**
- b. Display the option-set **Appearance**
- c. Activate the option **Command prompt**



Activate the command prompt

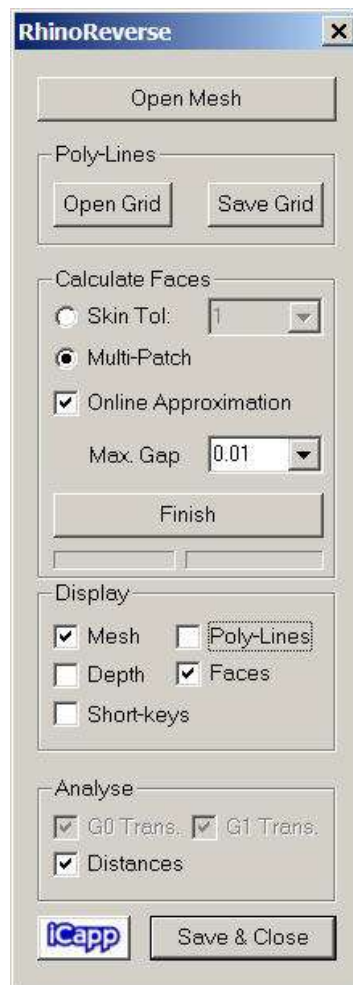
2 Start RhinoReverse™

Enter „RhinoReverse“ in the command prompt of Rhino. If it is the first start of RhinoReverse™, you will be asked for a license key:



RhinoReverse™ license request

With clicking on the button **Trial (15)...** you can test the software as long as your trial period is valid (number of remaining days is displayed in brackets). If you want to buy a license, please click on **Mail License Request**. An automatically created email including the given Node-ID will be prepared. Send the mail directly to iCapp GmbH (rhinoreverse@icapp.ch). They will generate a valid license key for the use on your computer only. Please enter the returned license key to the field of the dialog and click on **Register**.



Dialog „RhinoReverse™“

3 Read mesh data

- a. Push the button **Open Mesh**.

Attention 1: The given point cloud must be meshed. Point clouds, that exists of independent points, can not be used!

Attention 2: Big data amount leads to a slow view management and data handling. In this case an automatic decimation of mesh data will be done.

- b. Click the button **Short-keys**, to display the key and mouse commands in the command window of Rhino.

4 Define face boundaries by sketching poly lines

The file format with the extension *.grid is the RhinoReverse™ internal format, used to save all necessary data from the current state of poly line sketching and face approximation. We call this file “grid-file”.

If you already have sketched and stored any poly lines, you can open the grid-file by pushing the button **Open Grid** in order to continue working on the current case. (If you have not stored a grid-file before, please go on with section 3.1).

4.1 Sketch poly lines

- a. **Start point**. Press key “C” and set the desired **start point** with the left mouse button (Click on the desired location somewhere on the mesh).
- b. **Additional points**. Leave key “C” and click with the left mouse button arbitrary points somewhere on the mesh to add them to the current poly line. Click existing points with the left mouse button and drag them by moving the mouse.
- c. **Connect poly lines**. Create a connected **end point** by clicking with the left mouse button onto any existing poly line point of another poly line. Please hold key “D” pressed, or move the last created point onto any existing poly line point by using the left mouse button.

When four poly lines build a closed loop, the loop will be filled with a face. Poly lines that consist of only one single point will be deleted automatically from time to time.

Attention: *If you want to use the option **Skin** (see section 4) you only have to sketch four curves to define the boundary of the skin face!*

4.2 Edit poly lines

- c. **Activate** any poly line by clicking it with the left mouse button and hold key “Alt” pressed. The active line is highlighted in orange.
- d. **Move** single points of the active line, by selecting and moving them with the left mouse button.
- e. **Merge**. Press key “A” and click with the left mouse button on the connecting point of two or three poly lines. Both poly lines (if three lines run in the point, those two with the smallest angle) will be merged into a new poly line.
- f. **Split a** poly line by using key “X” and clicking the split point with the left mouse button. If you click once again on the same point the new start point will be moved a little bit.
- g. **Delete points**. Click the point you want to delete with the right mouse button and hold “Alt” key pressed.
- h. **Delete poly lines**. Activate the poly line and press key **Delete**.
- i. **Save grid** data from time to time. All information of the poly lines and the current faces of RhinoReverse™ will be stored by pressing the button **Save Grid**. The file extension of the generated file is *.grid.

5 Calculate faces

Method 1: Skin

The **Skin** method is very fast and effective, if the user wants to get a face representation of the global shape: He has to sketch four boundary curves, in order to define the mesh area to be wrapped. As soon as the four poly lines build a close loop, a start face will be calculated automatically. An additional tolerance value (**Tol**) could be set to determine the maximum acceptable distance between the resulting face and the given mesh. The calculation of the resulting face will be done when pushing the button **Finish**.

Method 2: Multi-Patch

By the use of several faces, design intentions like feature lines can be represented more smoothly: The user has to sketch a grid, containing all boundary curves for all desired faces. The representation by such multi-patch model is smoother than using the skin function of method 1.

- a. **Automatically calculation.** As soon as four poly lines or four sections of poly lines build a loop, a face will be calculated automatically inside the loop.

Attention: The tangents between the faces will be calculated by pushing the **Finish**-button.

- b. **Distances between faces and mesh.** Use the option **Distances** to check the distances between the given mesh and the new faces. The colour coding will take place between (-0.15 / + 0.15), if the mode **Multi-Patch** is active.

Black	< - 0.15
Dark Blue	-0.15 - -0.10
Light Blue	-0.10 - -0.05
Green	-0.05 - 0.05
Yellow	0.05 - 0.10
Red	0.10 - 0.15
White	>0.15

Using the mode **Skin** the colour coding will be adjusted to +/- **Tol**. Please set the accepted tolerance in the edit field **Tol**.

- c. **Transitions between faces.**
- a. The angle-deviations between the faces can be watched while calculating the transitions. Please set the option **G0-Trans** for the position- and **G1-Trans** for the angle-deviation at the face boundaries.

All angle-deviations bigger than 0.1° will be displayed as red lines. The length is scaled by the deviation value.

- b. All position-deviations bigger than the maximum gap-tolerance (default: 0.01) will be displayed by coloured points. Please change **Max. Gap**. In the edit-field if you like to use another target tolerance.