

DYNAFORM 5.1 Training Manual

BSE and DFE

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June, 2004

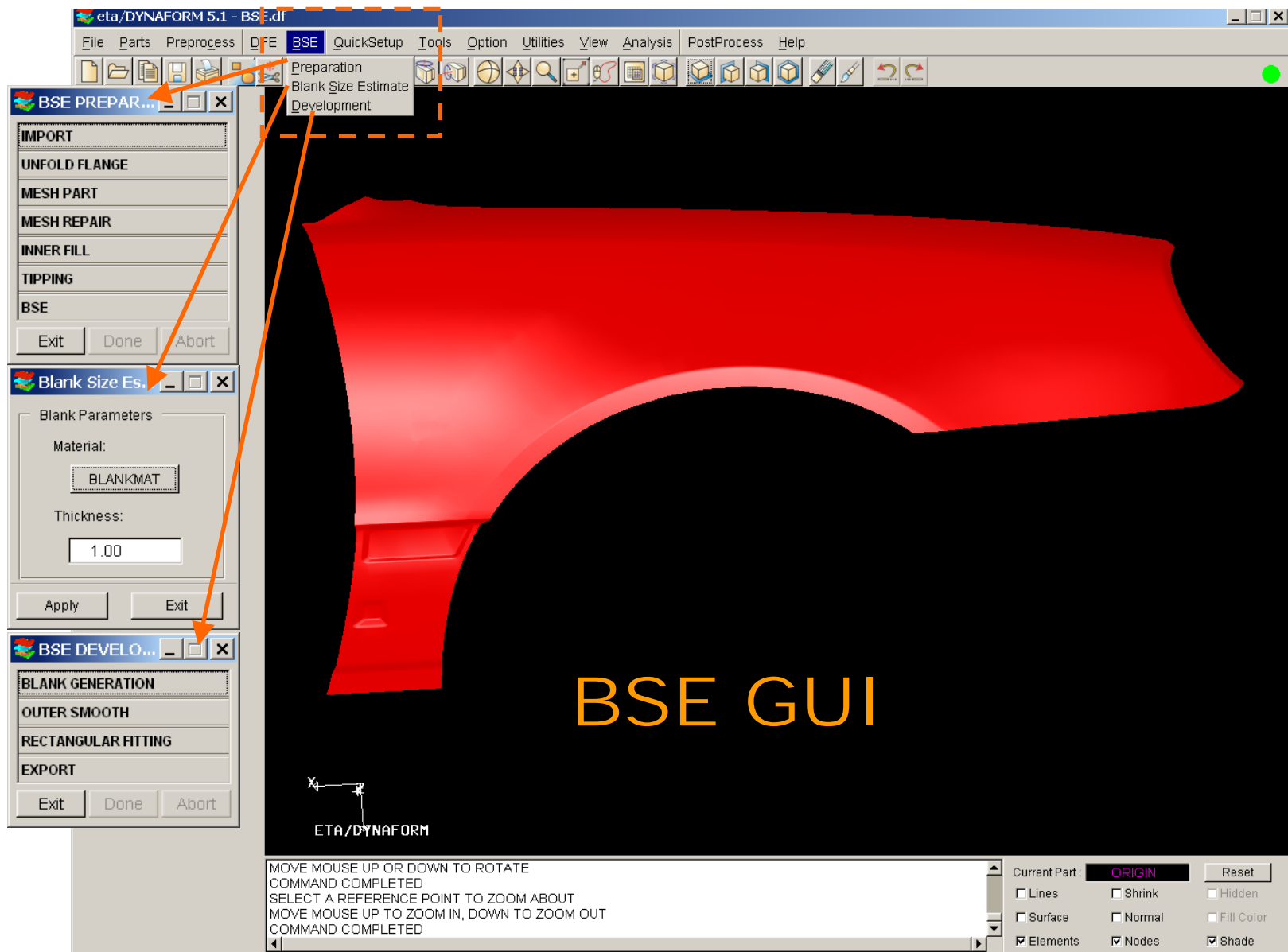
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- Introduction
- Tutorial I: Coat Hanger
 - ❖ BSE and Blank Development
- Tutorial II: Roof Bow
 - ❖ Boundary Line Binder and Direct Trim
- Tutorial III: Exhaust Muffler
 - ❖ Flat Binder and CAM Trim
- Tutorial IV: Hood Inner
 - ❖ Flat Binder and Auto Addendum
- Tutorial V: Door Outer
 - ❖ 2-Line Binder and Auto Addendum
- Tutorial VI: Hyundai Fender
 - ❖ Conical Binder, Addendum Edit and Drawbar

➤ BSE (Blank Size Estimator)

- ❖ Based on One Step analysis
- ❖ Quickly estimate blank size
- ❖ Blank development for press shop and virtual stamping
- ❖ Material cost estimation
- ❖ Blank nesting
- ❖ Tool chest
 - ✓ Part tool mesher
 - ✓ Automatic and Manual Tipping
 - ✓ Automatic and Manual hole filling, outer smooth and boundary filling
 - ✓ Unfold flange
 - ✓ Generation of blank

Introduction



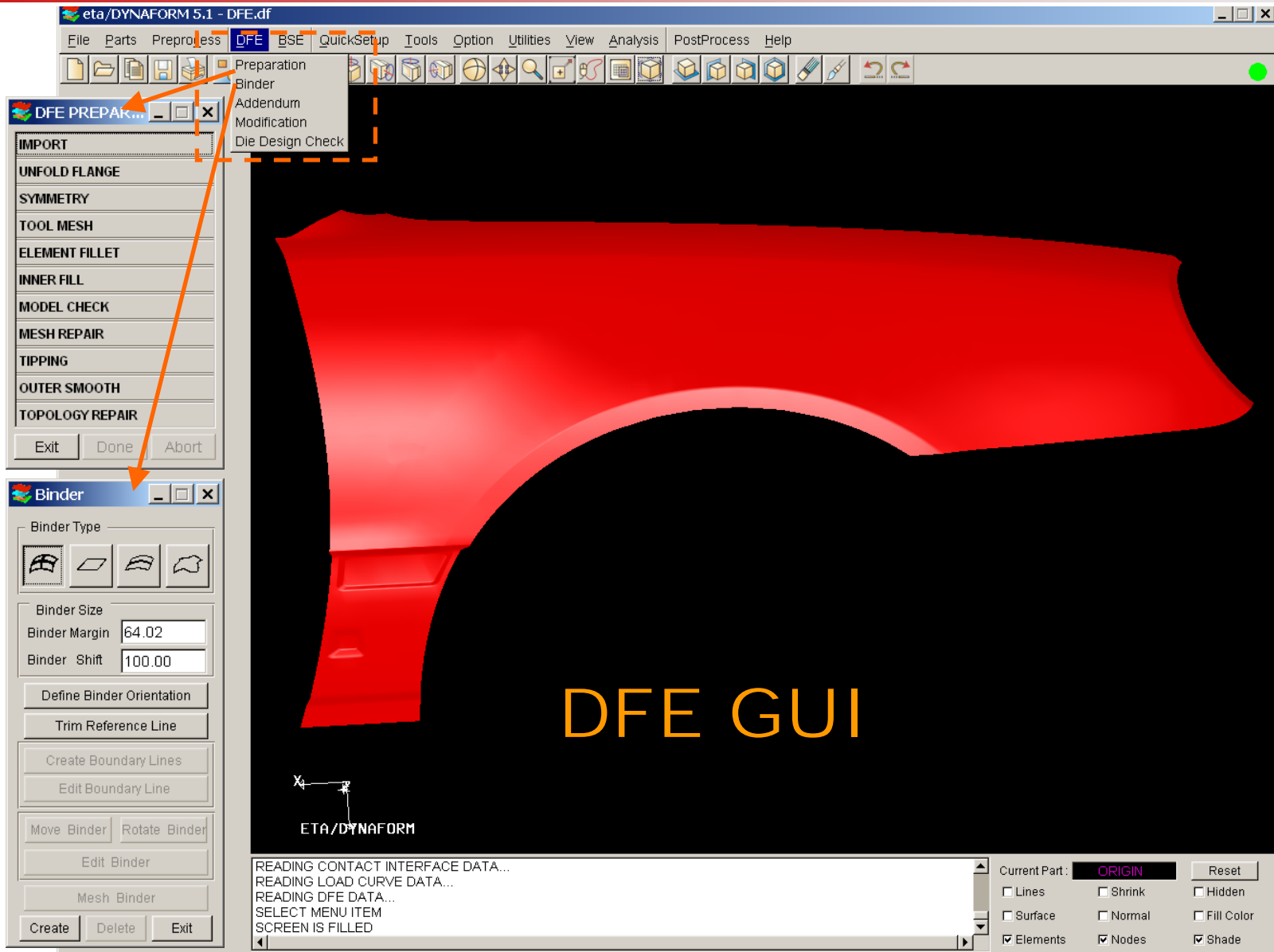
➤ DFE (Die Face Engineering)

- ❖ Early stage tool concept design based on part geometry
- ❖ Evaluation of tool concept via virtual stamping
- ❖ Parametric and Associative
- ❖ Tool chest
 - ✓ Automatic variable filleting for sharp edges
 - ✓ Automatic or manual filling of holes, boundary fill and outer boundary smooth
 - ✓ Automatic or manual tipping and adjusting the drawing direction
 - ✓ Automatic and interactive generation or modification of a binder

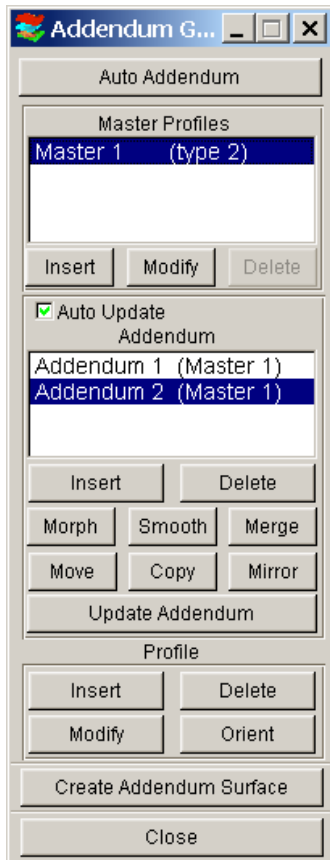
Tool chest continue...

- ✓ Automatic and interactive generation or modification of outer and inner addenda
- ✓ Morphing part or die geometries
- ✓ Unfold flange function
- ✓ Drawbar generation
- ✓ Various trimming capabilities
- ✓ Die design checking

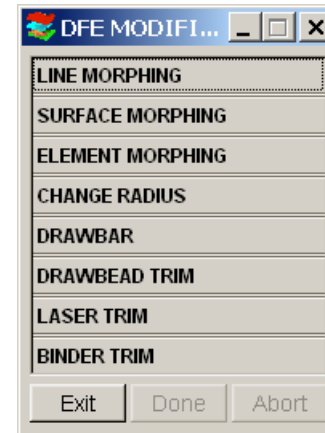
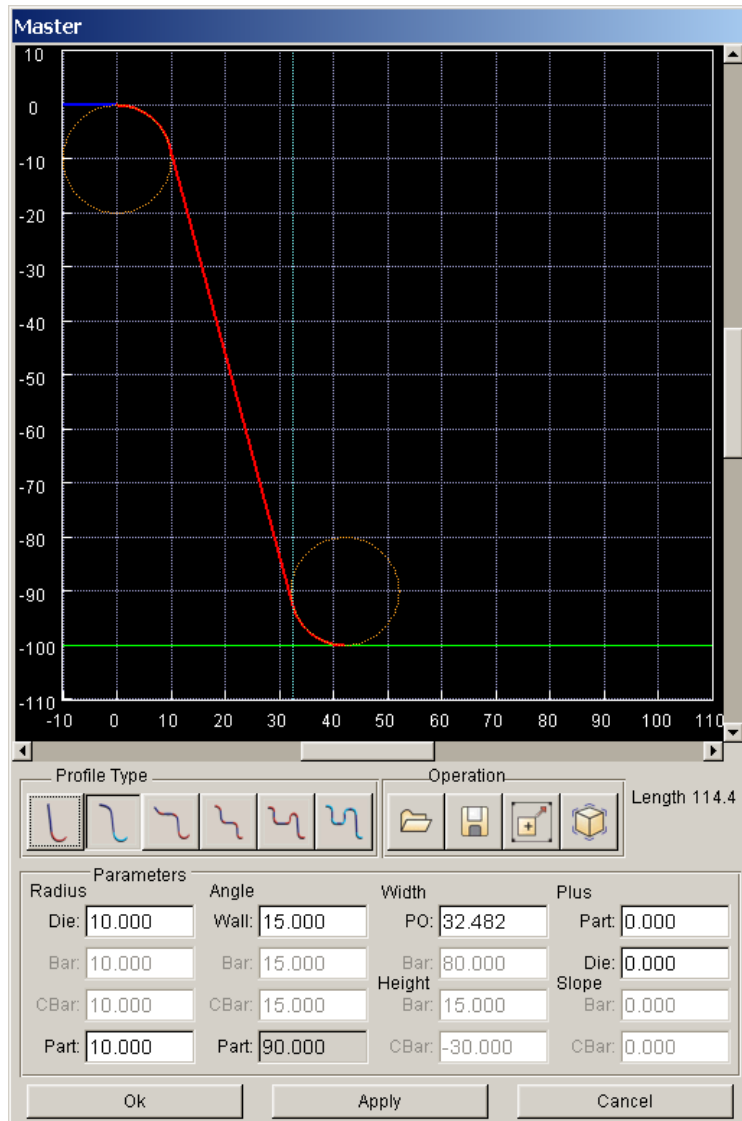
Introduction



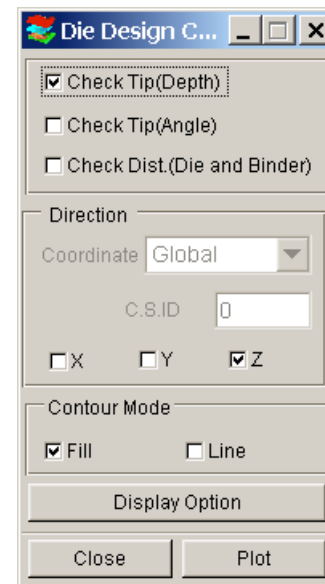
Introduction



Addendum



Modification



Die Design Check

Tutorial I

Coat Hanger to show Blank Size Estimate and Blank Development

BSE and Blank Development procedures:

- i. Open and save database
- ii. Importing part geometry
- iii. Rename Part
- iv. Auto-Meshing the part
- v. Check and repair meshes
- vi. Blank Size Estimate
- vii. Rectangular Fit
- viii. Blank Generation
- ix. Blank Outer Smooth
- x. Generate new blank outline and blank mesh



i. Open and save database

- a) Execute Dynaform 5.1

For PC users: Double click on  icon from the desktop

For Unix/Linux users: Type “df51” on the command line and hit the Enter key

- b) Click on *File* and select *Save As ...* (See Figure 1.1)
- c) Type in “hanger_(user name)_(date).df” as File Name
- d) Click on **Save**

ii. Import part geometry

- a) Click on *BSE* (See Figure 1.2)
- b) Select *Preparation*
- c) Click **IMPORT**
- d) Select File location: .../Tutorial1_Hanger
- e) Pick File name: hanger.igs
- f) Click **Ok** to import the part geometry
- g) Click **Exit** to dismiss BSE Preparation dialog window

Tutorial I

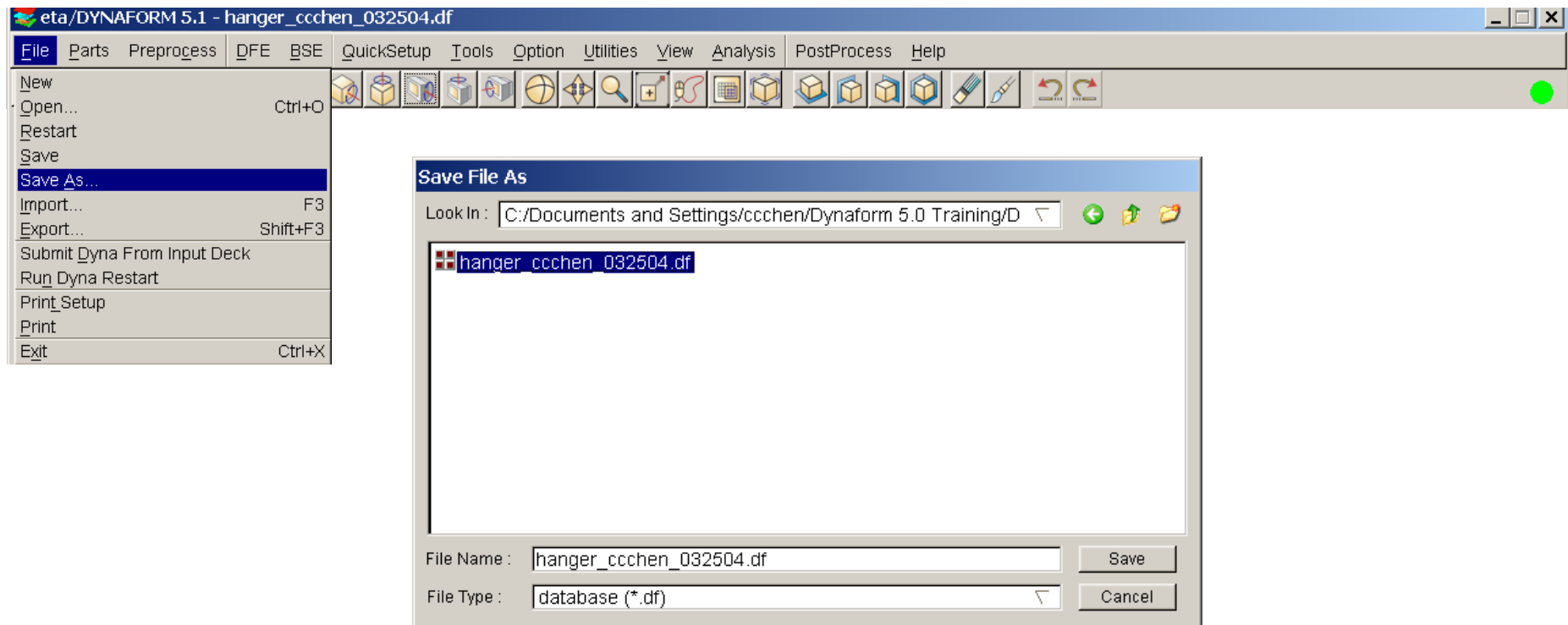


Figure 1.1

Tutorial I

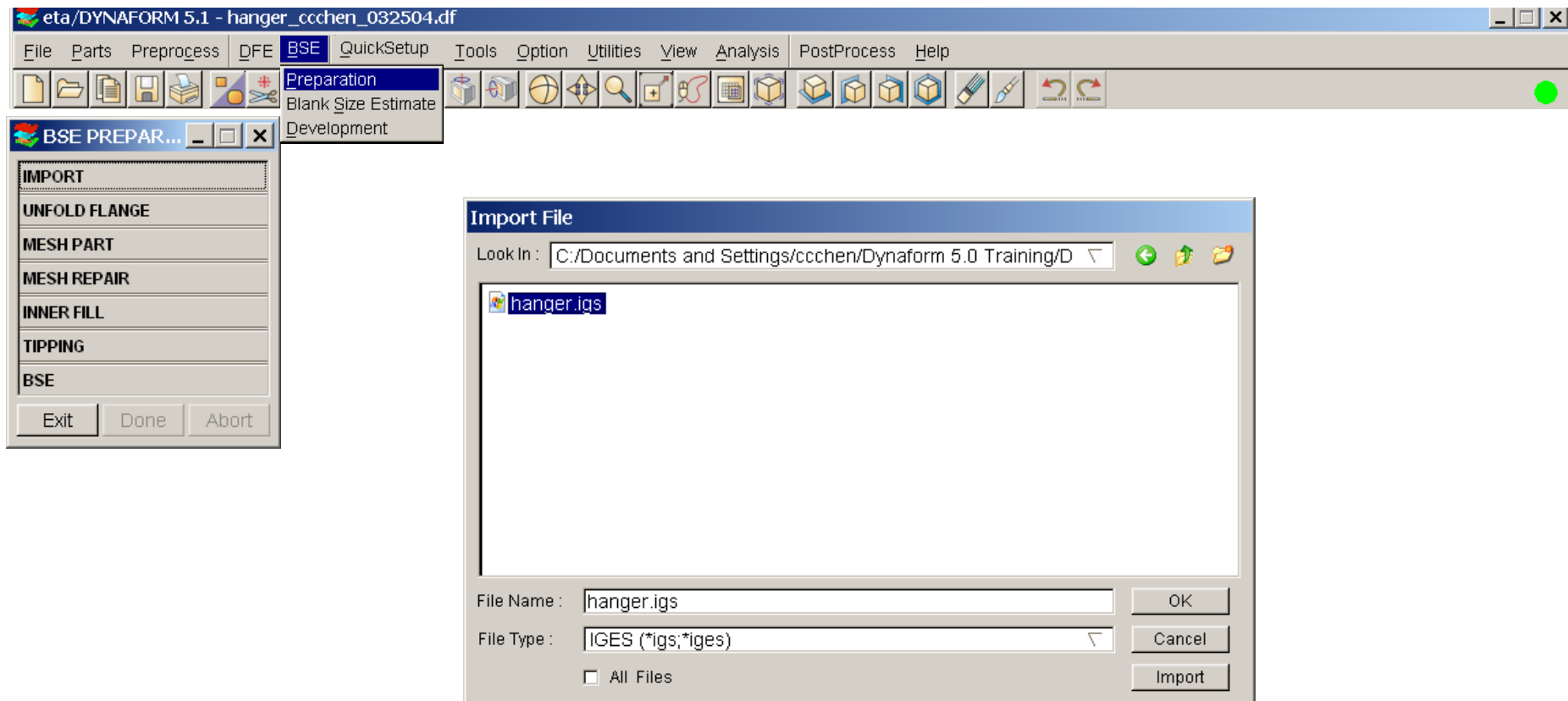


Figure 1.2

iii. Rename Part

- Click on **Parts** (See Figure 1.3)
- Select **Edit**
- Double click on the input box for Name to highlight Part C001V000
- Type in “**HANGER**”
- Click **Modify**
- Click **OK** to dismiss Edit Part dialog window

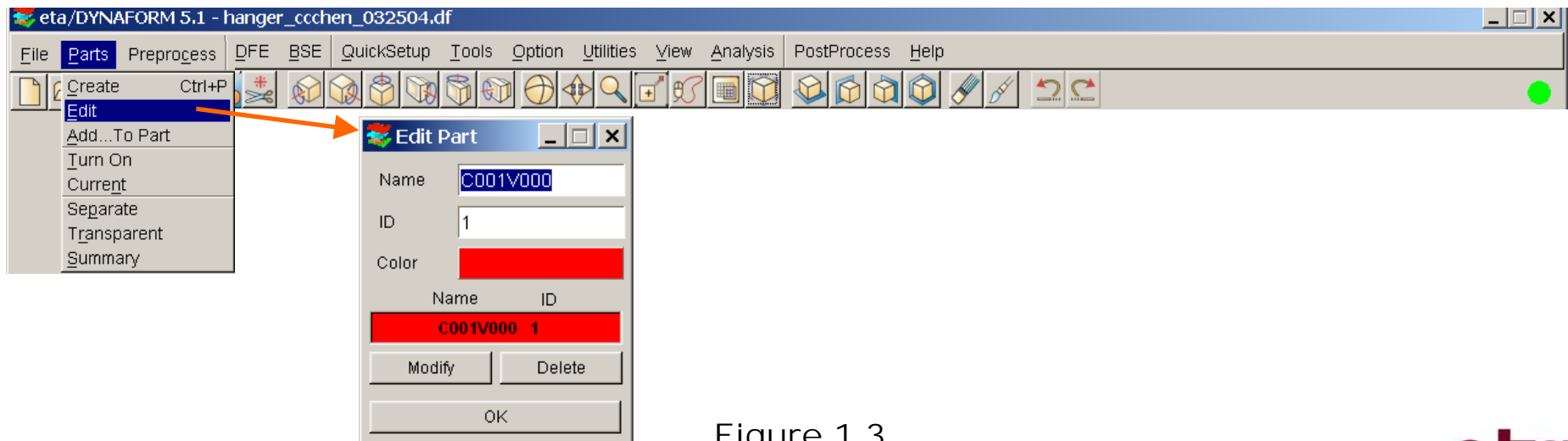


Figure 1.3

iv. Auto-Meshing the surfaces

- a) Select **MESH PART** (See Figure 1.4)
- b) Click **Displayed Surf** icon to select all the part geometry
- c) Click **OK** to confirm surface selection

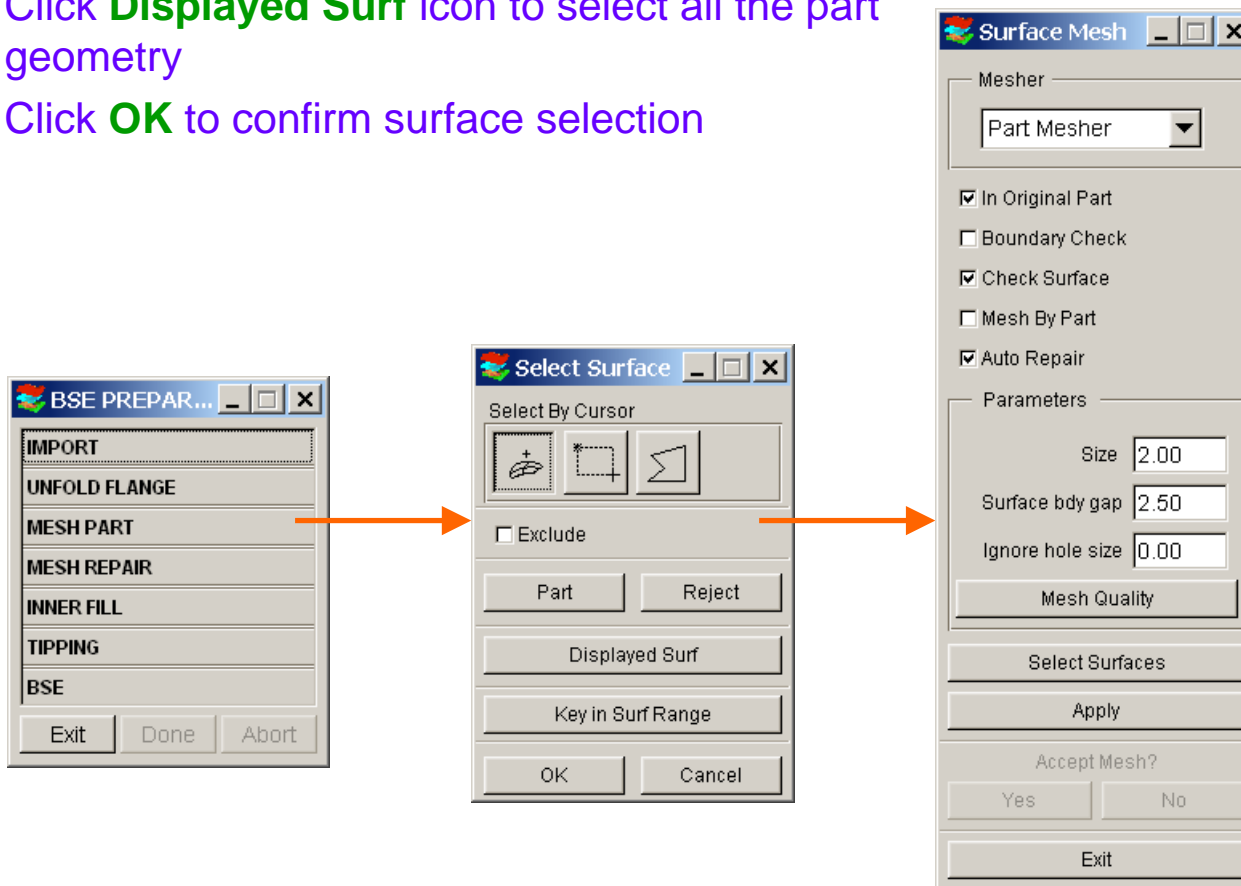


Figure 1.4

Tutorial I

Auto-Meshing the surfaces continue....

- d) Pick **Part Mesher**
- e) Key in Size, **2.00** (mm)
- f) Click on **Apply**
- g) Click **OK** to dismiss MESH QUALITY CHECK dialog window (See Figure 1.5)
- h) Click **YES** to accept the mesh
- i) Click **Exit** to dismiss Surface Mesh dialog window
- j) See Figure 1.6

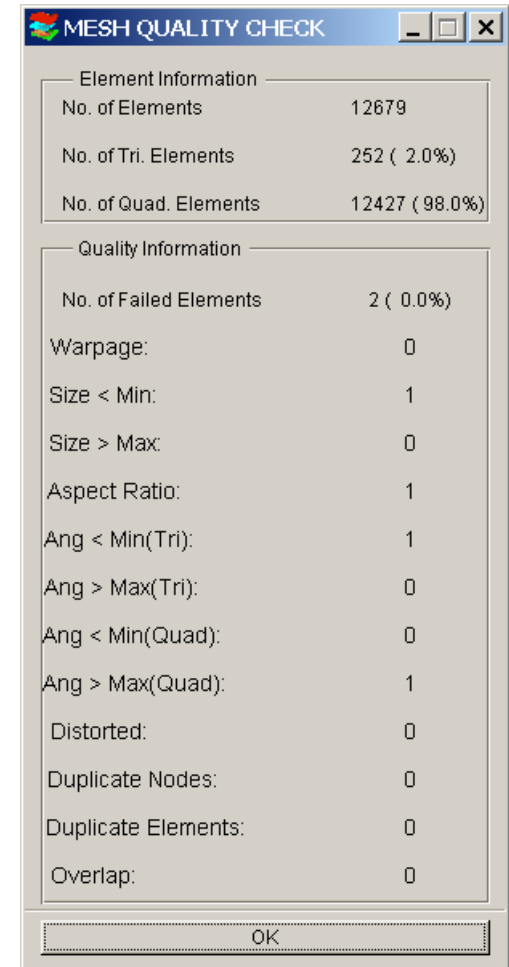


Figure 1.5

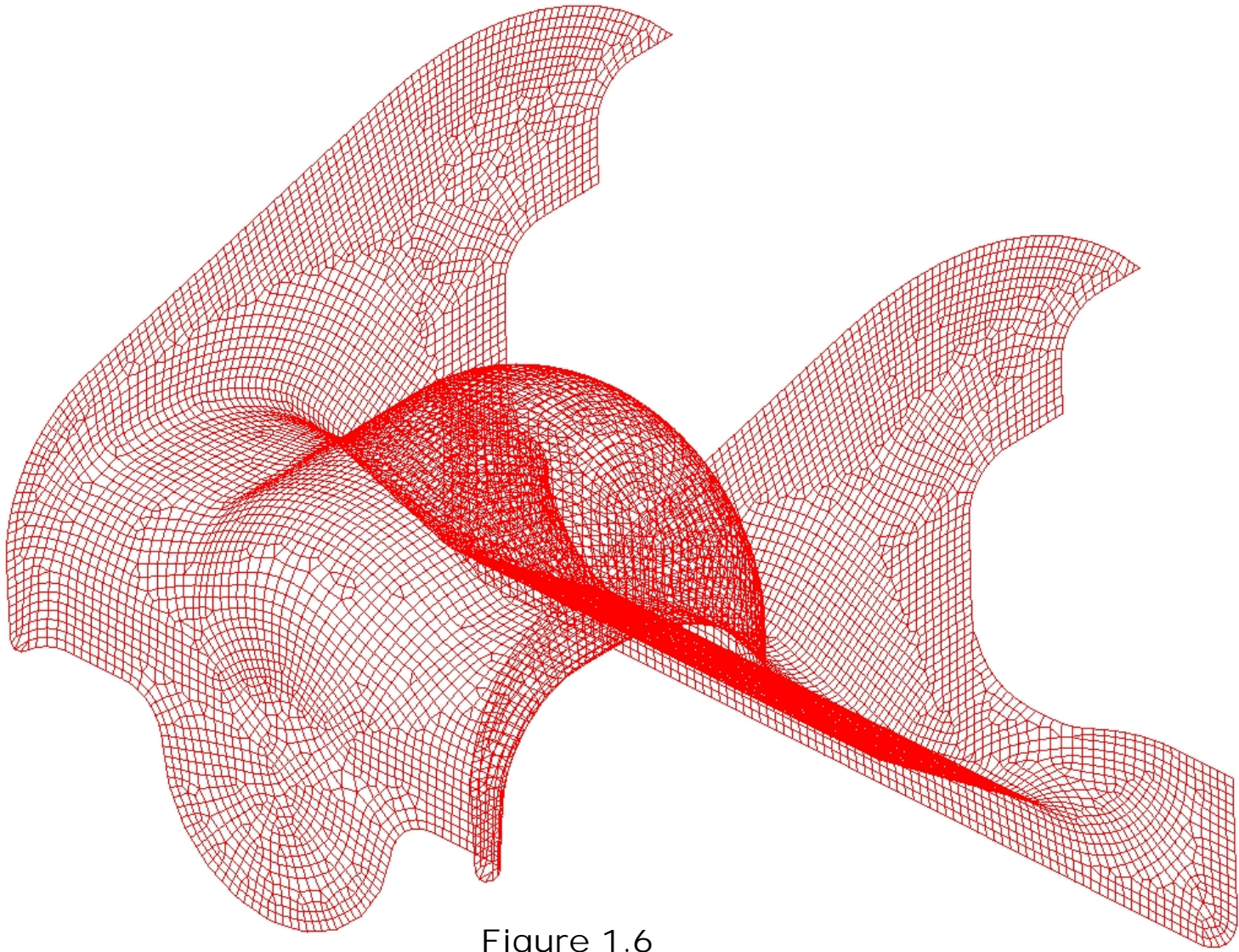





Figure 1.6

Tutorial I

v. Check and repair meshes

- a) Toggle off “Surface” on the display option (see Figure 1.8)
- b) Select **MESH REPAIR**
- c) Click on **Boundary Display** icon (Icon R3C1) (see Figure 1.9)
- d) Toggle off “Elements” and “Node”
- e) Click  (Free rotate) to rotate the part
- f) Click  (Clear highlight)
- g) Click  to display isometric view
- d) Click on **Auto Normal** icon (Icon R3C2)
- e) Select **CURSOR PICK PART**
- f) Move cursor to pick an element on the part (as shown in Figure 1.10)

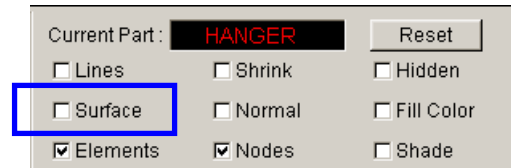


Figure 1.8

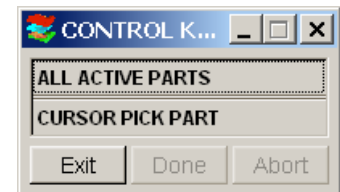
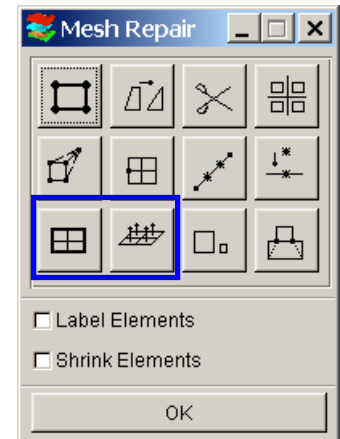


Figure 1.9

Tutorial I

Repair meshes continue...

- g) Select **No** to reverse normal direction (as shown in Figure 1.11)
- h) Click on **Exit** to dismiss the dialog window
- i) Click **OK** to dismiss Mesh Repair dialog window
- j) Click **Exit** to dismiss BSE Preparation dialog window

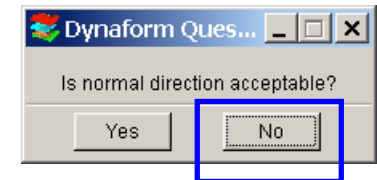


Figure 1.11

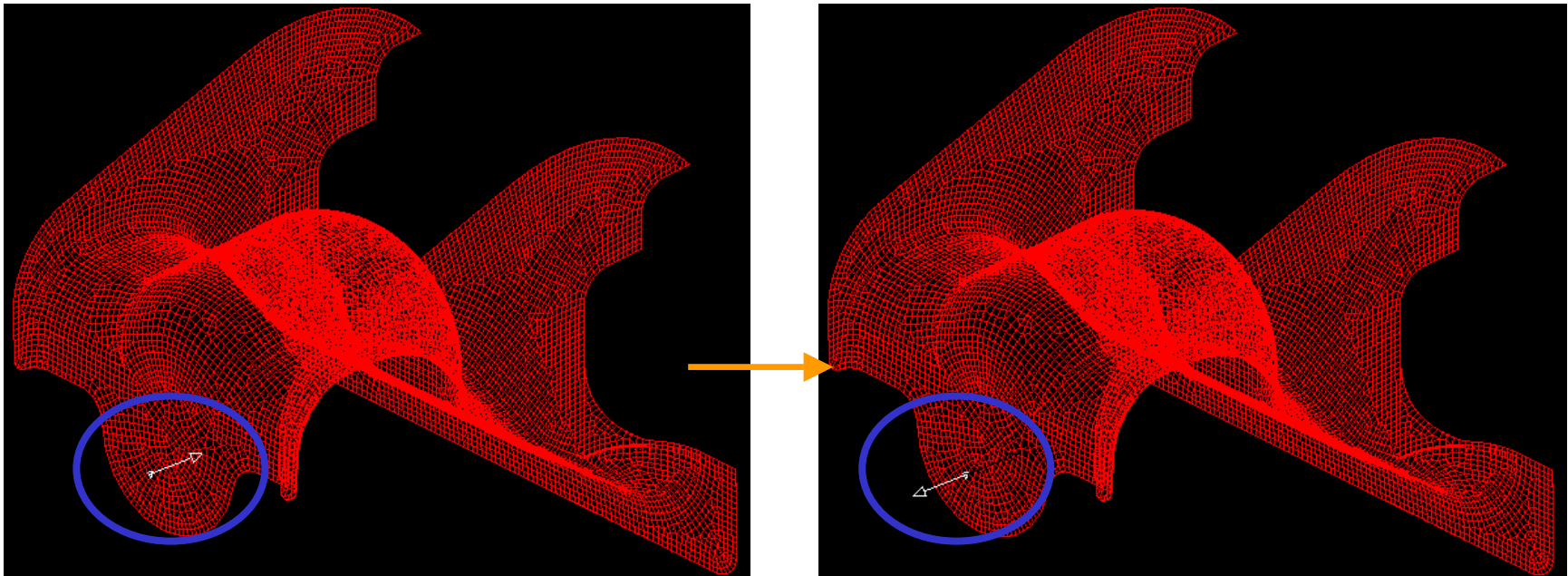


Figure 1.10

vi. Blank Size Estimate

- Click on **BSE**
- Select **Blank Size Estimate**
- Click “**NULL**” to define Material (See Figure 1.12)

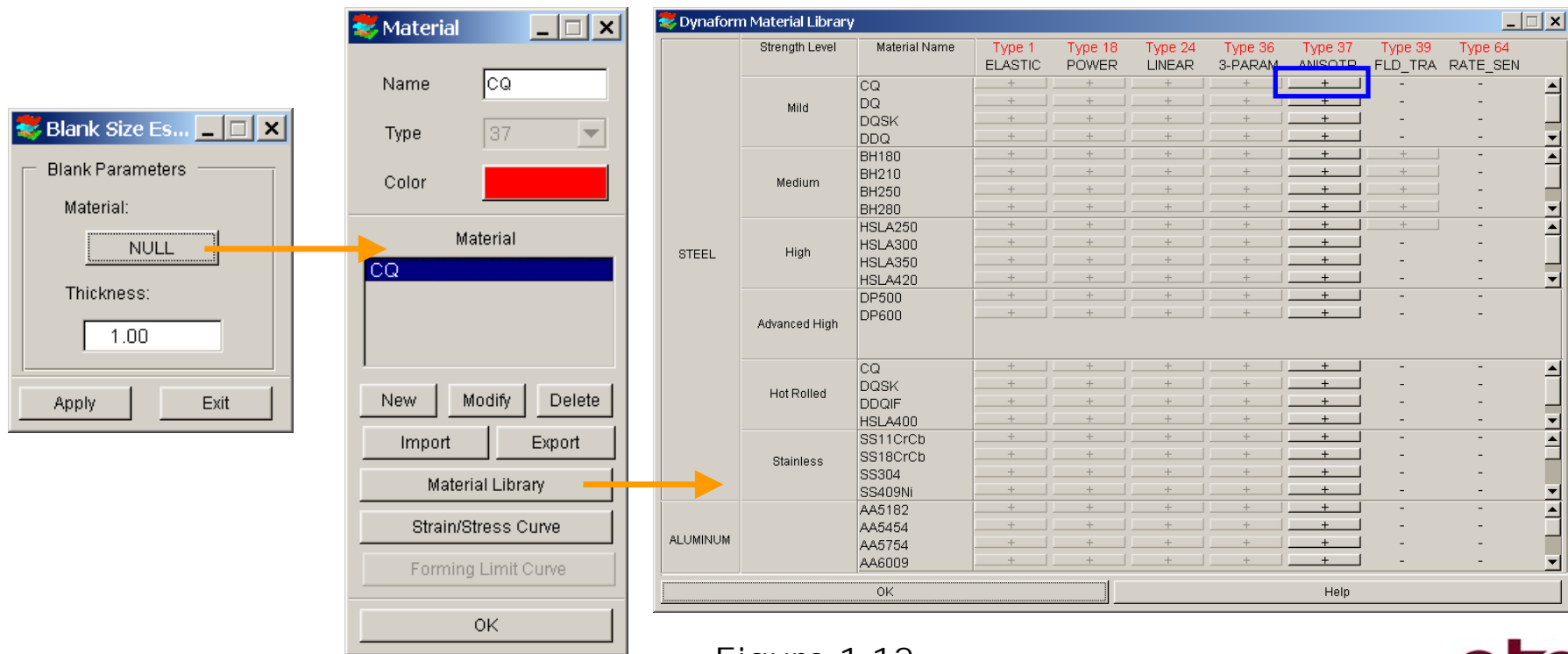



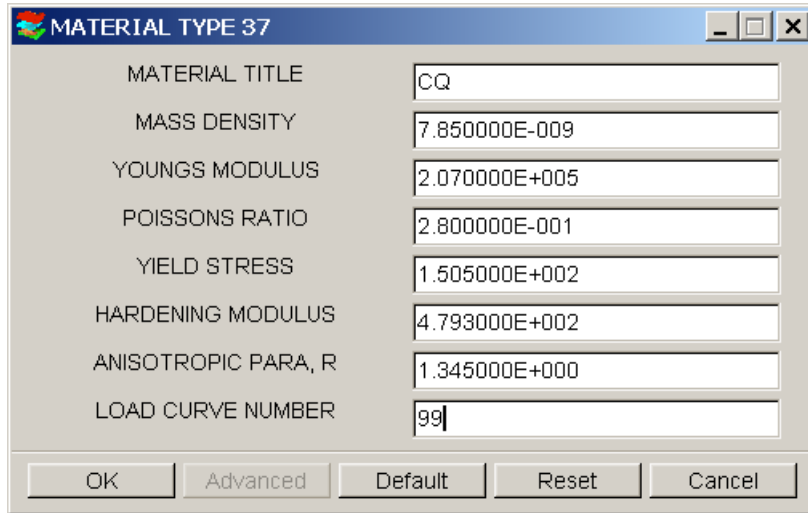


Figure 1.12

Blank Size Estimate continue...

- d) Click **Material Library**
- e) Pick CQ (mild) as material (See Figure 1.12)
- f) Click **OK** to dismiss MATERIAL TYPE 37 dialog window (as shown in Figure 1.13)
- g) Click **OK** to dismiss Material definition dialog window
- h) Key in blank thickness, **1.20** (mm) (Figure 1.14)
- i) Click on **Apply** to run BSE
- j) Click **Exit** to dismiss BSE Preparation dialog window
- k) Click  to turn parts on/off
- l) Select **HANGER** and click **OK**
- m) Click  to display isometric view of blank outline (as shown in Figure 1.15)
- n) Click on  to save the database

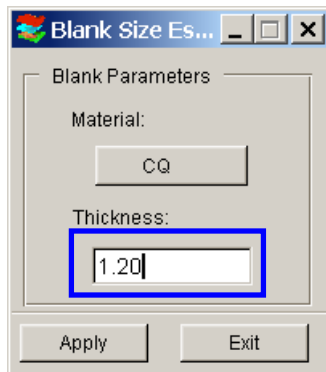
Tutorial I



A dialog box titled "MATERIAL TYPE 37" with a standard Windows window frame. It contains a list of material properties on the left and corresponding input fields on the right. The properties and their values are: MATERIAL TITLE (CQ), MASS DENSITY (7.850000E-009), YOUNGS MODULUS (2.070000E+005), POISSONS RATIO (2.800000E-001), YIELD STRESS (1.505000E+002), HARDENING MODULUS (4.793000E+002), ANISOTROPIC PARA, R (1.345000E+000), and LOAD CURVE NUMBER (99). At the bottom, there are five buttons: OK, Advanced, Default, Reset, and Cancel.

Property	Value
MATERIAL TITLE	CQ
MASS DENSITY	7.850000E-009
YOUNGS MODULUS	2.070000E+005
POISSONS RATIO	2.800000E-001
YIELD STRESS	1.505000E+002
HARDENING MODULUS	4.793000E+002
ANISOTROPIC PARA, R	1.345000E+000
LOAD CURVE NUMBER	99

Figure 1.13



A dialog box titled "Blank Size Es..." with a standard Windows window frame. It contains a section titled "Blank Parameters" with a "Material:" label and a button labeled "CQ". Below this is a "Thickness:" label and an input field containing the value "1.20". The input field is highlighted with a blue rectangular border. At the bottom, there are two buttons: Apply and Exit.

Figure 1.14

Estimated blank outline

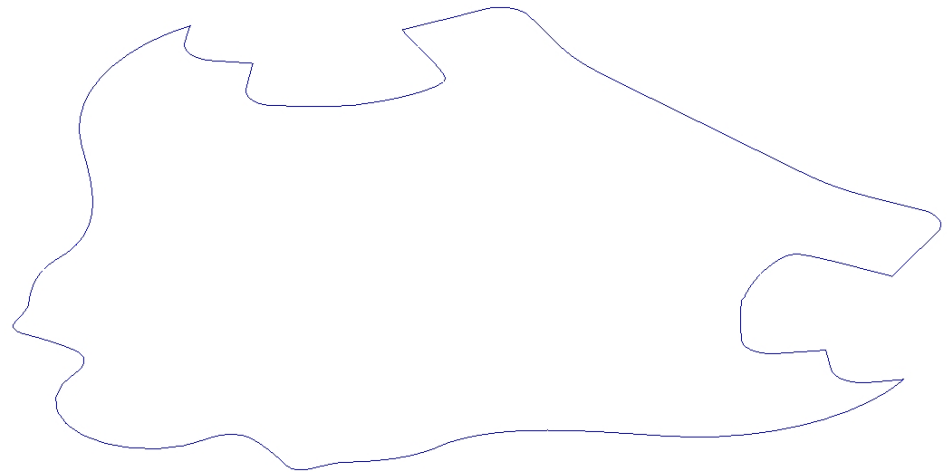


Figure 1.15

vii. Rectangular Fit

- a) Click  to display top view
- b) Click on *BSE*
- c) Select *Development*
- d) Select **RECTANGULAR FITTING** (Figure 1.16)
- e) Toggle on “Manual Fit” (Figure 1.17)
- f) Click **Select Line**
- g) Select the blank outline
- h) Click **OK** to exit Select Line dialog window
- i) Click on **Apply** to create rectangular blank outline (as shown in Figure 1.18)
- j) Click **Close** to dismiss Rectangular Fitting dialog window
- k) Click on  to save the database

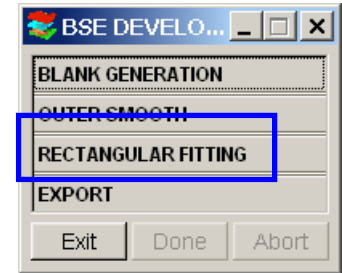


Figure 1.16

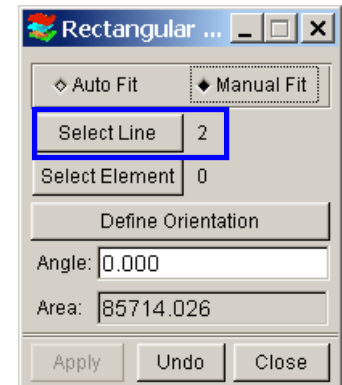


Figure 1.17

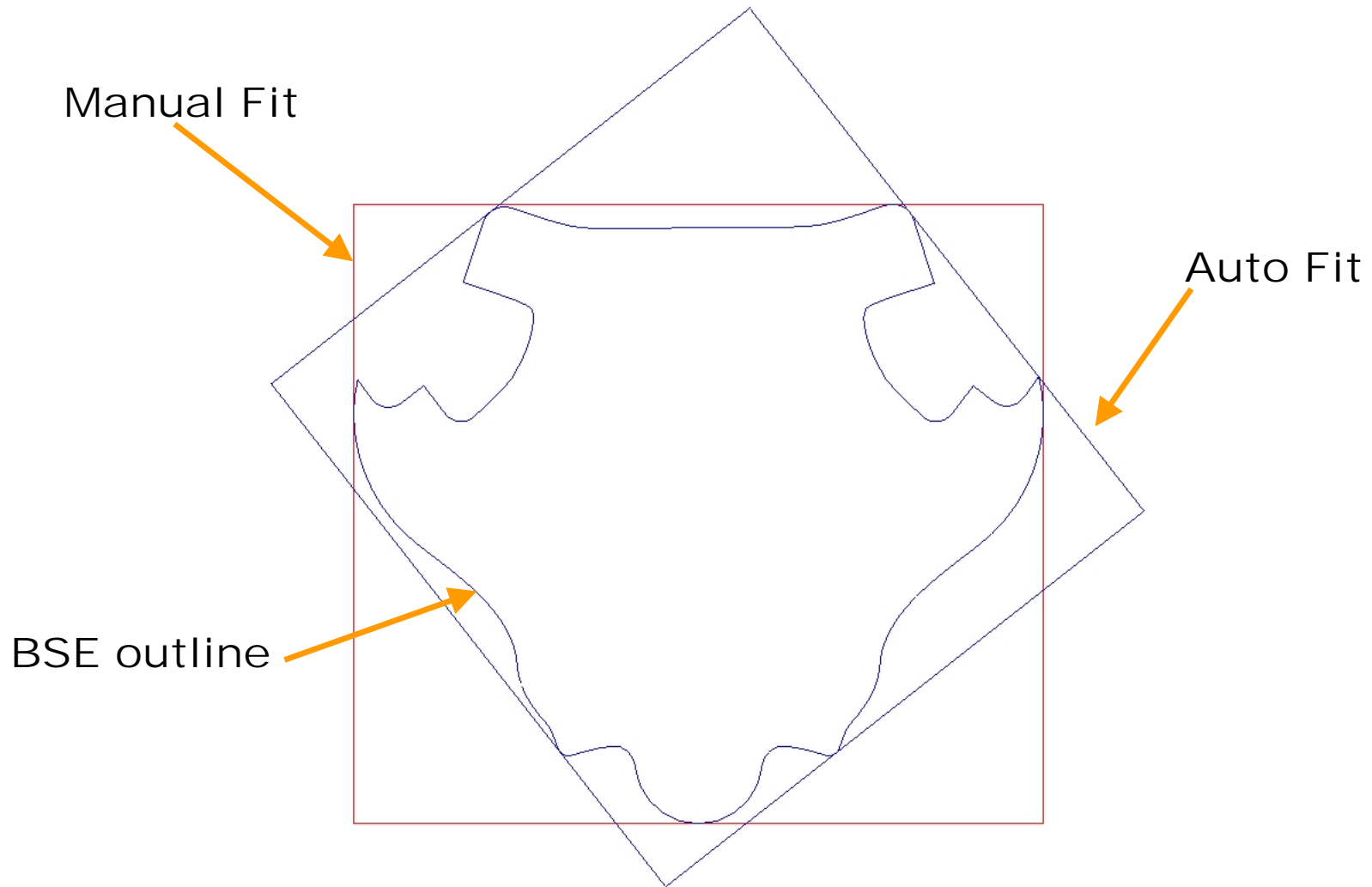


Figure 1.18

Tutorial I

viii. Blank Generation

- Toggle on “**E**lements” and “**N**odes” from display option window
- Click on **BSE**
- Select **Development**
- Select **BLANK GENERATION**
- Pick the BSE blank outlines
- Key in tool’s Min Radii, **2.00** (mm) (See Figure 1.19)
- Click **OK**
- Select **Yes** to accept the blank mesh (as shown in Figure 1.20)

Figure 1.20

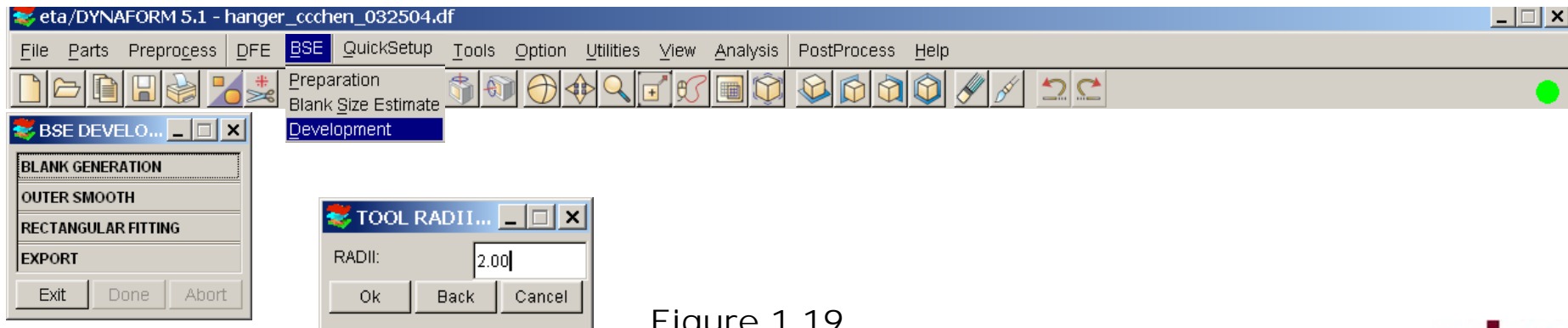
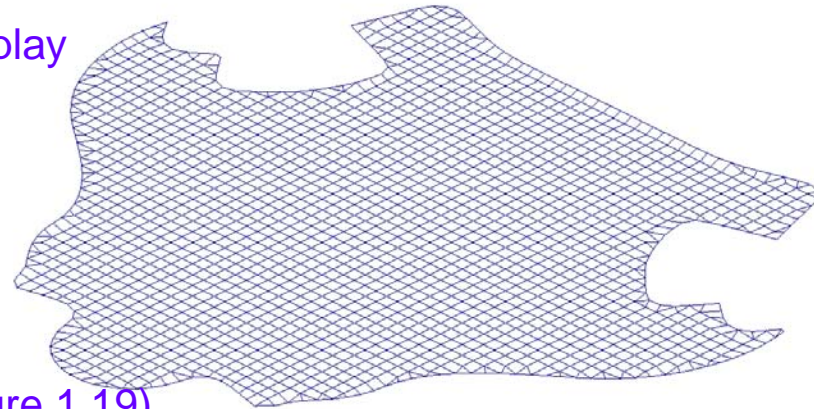


Figure 1.19

ix. Blank Outer Smooth

- a) Select **OUTER SMOOTH**
- b) Select **Roller** (See Figure 1.21)
- c) Key in Roll Radius, **300.00** (mm) (default)
- d) Click **Create Boundary**
- e) Click **Fill Boundary**
- f) Select **Expand** (See Figure 1.22)
- g) Click on **Boundary Expand** Key in Extension, **5.00** (mm)
- h) Click **Boundary Expand**
- i) Click **Fill Boundary**
- j) Click **Exit** to dismiss Outer Smooth dialog window
- k) Click **Exit** to dismiss BSE Development dialog window
- l) See Figs 1.23 and 1.24

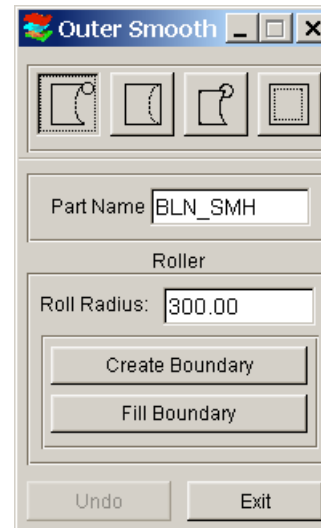


Figure 1.21

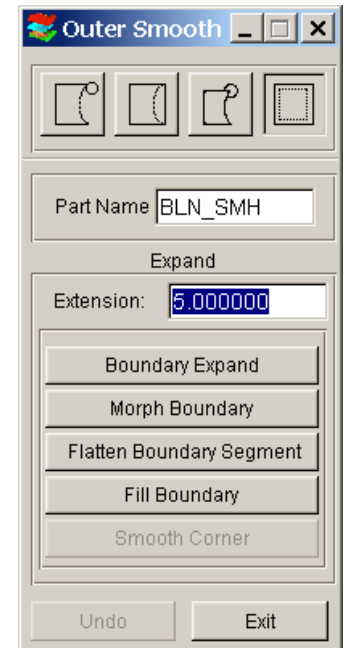


Figure 1.22

Tutorial I

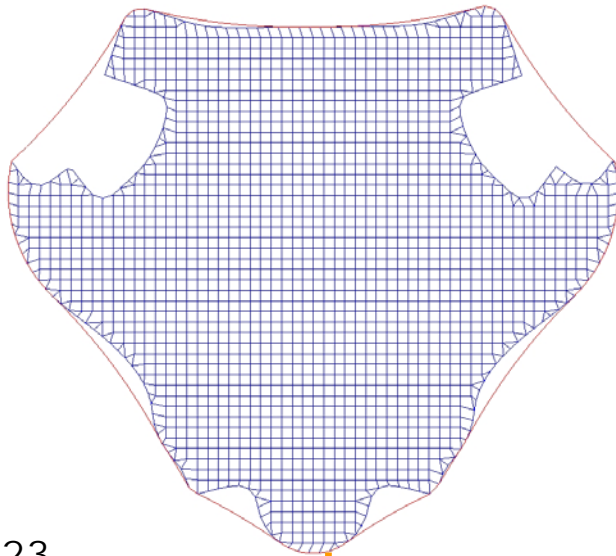


Figure 1.23

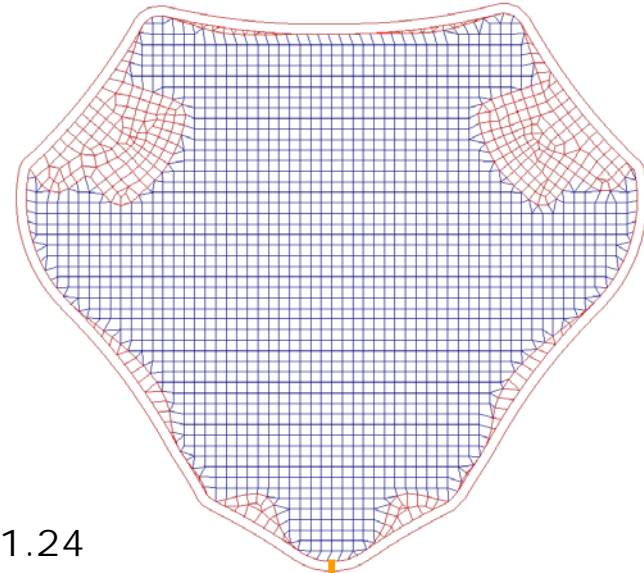
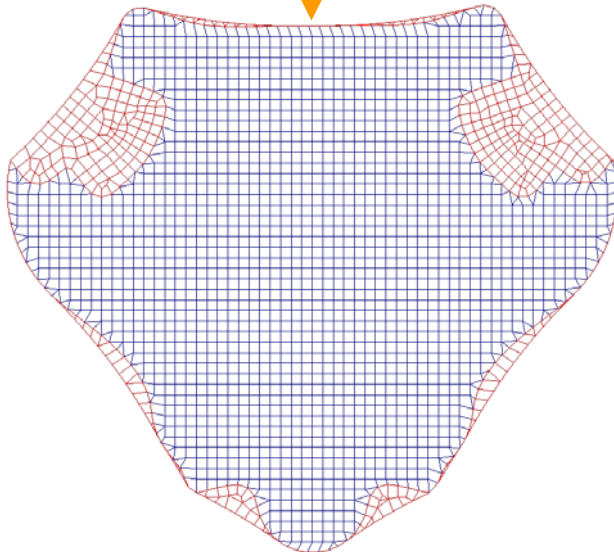
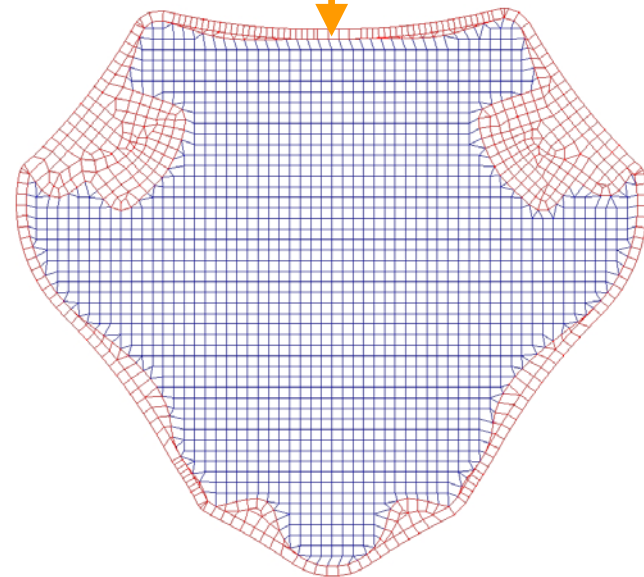


Figure 1.24



Tutorial I

x. Generate new blank outline and blank mesh

- a) Click on *Preprocess*
- b) Select *Line/Points*
- c) Click **FE Boundary Line** icon (Icon R5C3) (See Figure 1.25)
- d) Toggle on “In New Part” (See Figure 1.25)
- e) Key in Split Angle, **0°**
- f) Type “**BLANK**” as New Part Name
- g) Click **Ok** to generate new boundary line
- h) Turn off all part, except BLANK
- i) Click *Tools* and select *Blank Generator*
- j) Pick **BOUNDARY LINE** (See Figure 1.26)
- k) Select blank outline (See Figure 1.27)
- l) Click **OK** to exit Select Line dialog window
- m) Key in Radii, **3.00** (mm)
- j) Click **OK** to generate new mesh
- k) Click **Yes** to accept new blank mesh (as shown in Figure 1.27)

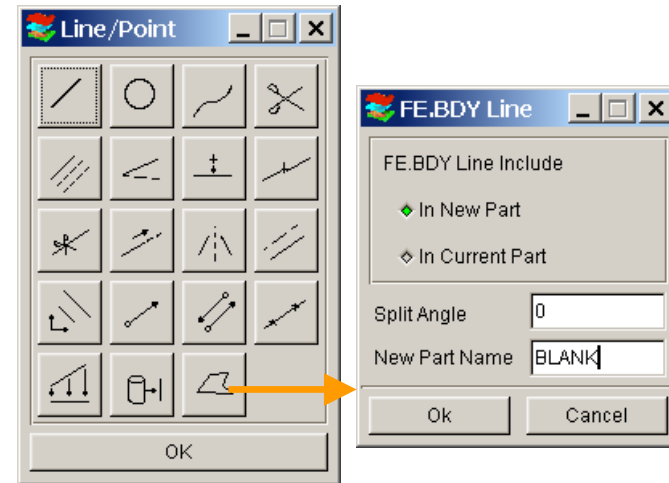
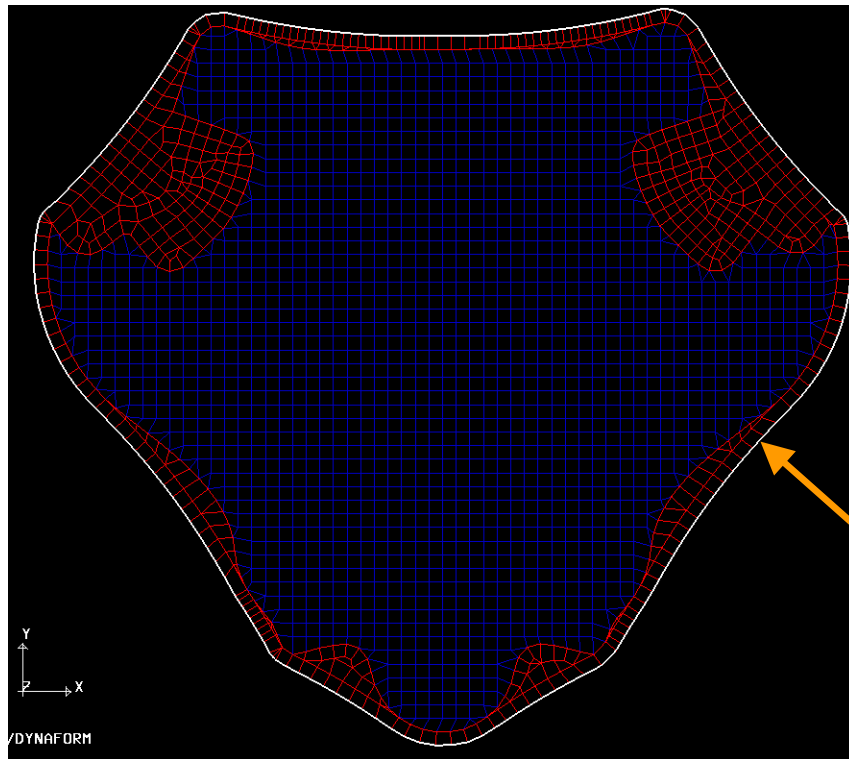


Figure 1.25

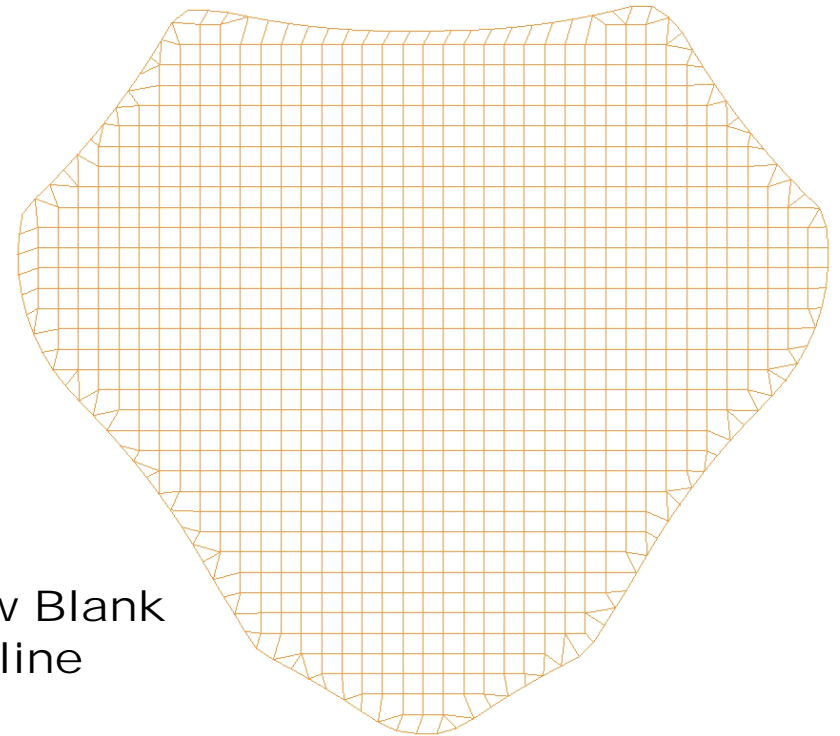


Figure 1.26

Tutorial I



New Blank Mesh



New Blank
Outline

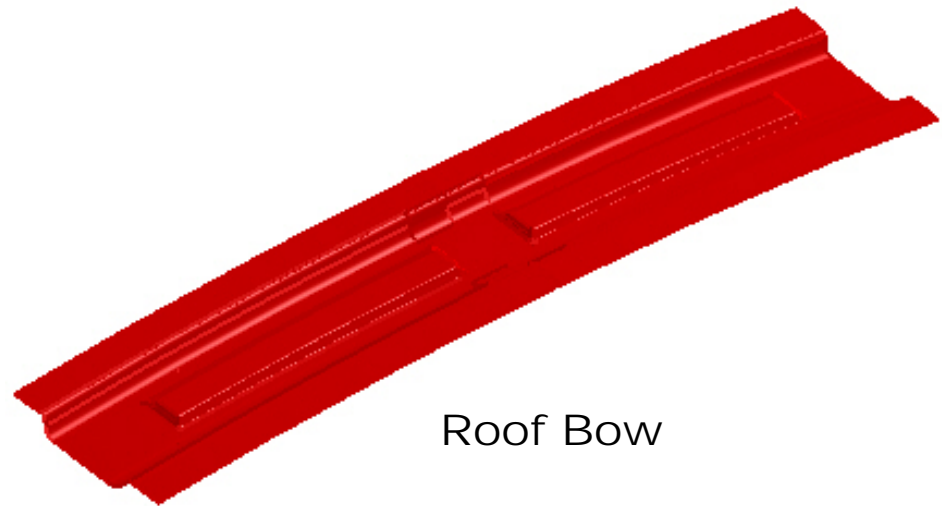
Figure 1.27

Tutorial II

Roof Bow to show Boundary Line binder, Direct Trim (Part on binder application)


Roof Bow DFE procedures :

- i. Open and save database
- ii. Importing part geometry
- iii. Rename part
- iv. Auto-Meshing the surfaces
- v. Check and repair meshes
- vi. Tipping
- vii. Create Boundary Line Binder
- viii. Create master profile
- ix. Insert addendum
- x. Insert profile
- xi. Create corner addendum
- xii. Create addendum surface
- xiii. Binder trimming
- xiv. Generate trimline for Direct Trim application



Roof Bow

i. Open and save database

- a) Click on  to create a new database
- b) Click **Yes** to save the database
- c) Click on *File* and select *Save As ...*
- c) Type in “roofbow_(user name)_(date).df” as File Name
- d) Click on **Save**

ii. Import part geometry

- a) Click on *DFE* (See Figure 2.1)
- b) Select *Preparation*
- c) Click **IMPORT**
- d) Select File location: .../Tutorial2_RoofBow
- e) Pick File name: roof_bow.igs
- f) Click **Ok** to import the part geometry

Tutorial II

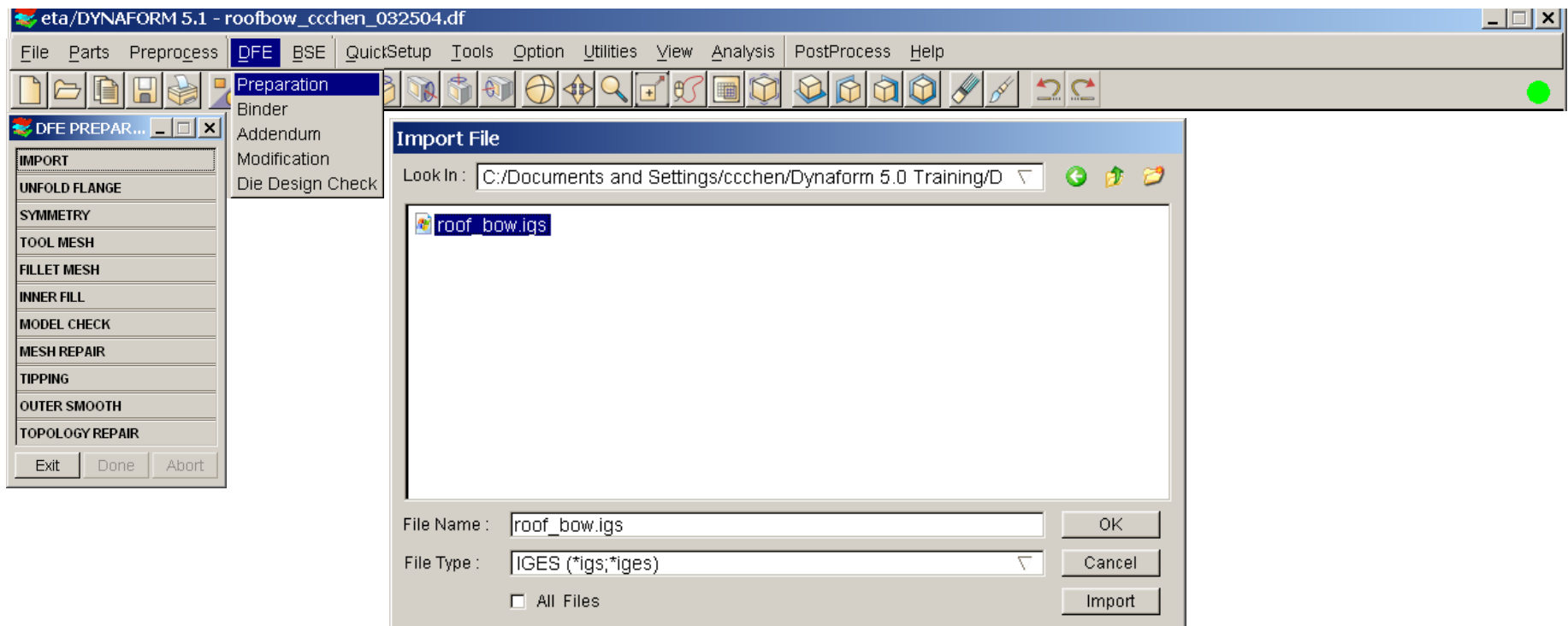


Figure 2.1

Tutorial II

iii. Rename Part

- Click on **Parts** (See Figure 2.3)
- Select **Edit**
- Double click on the input box for Name to highlight Part C001V000
- Type in “**ROOFBOW**”
- Click **Modify**
- Click **OK** to dismiss Edit Part dialog window

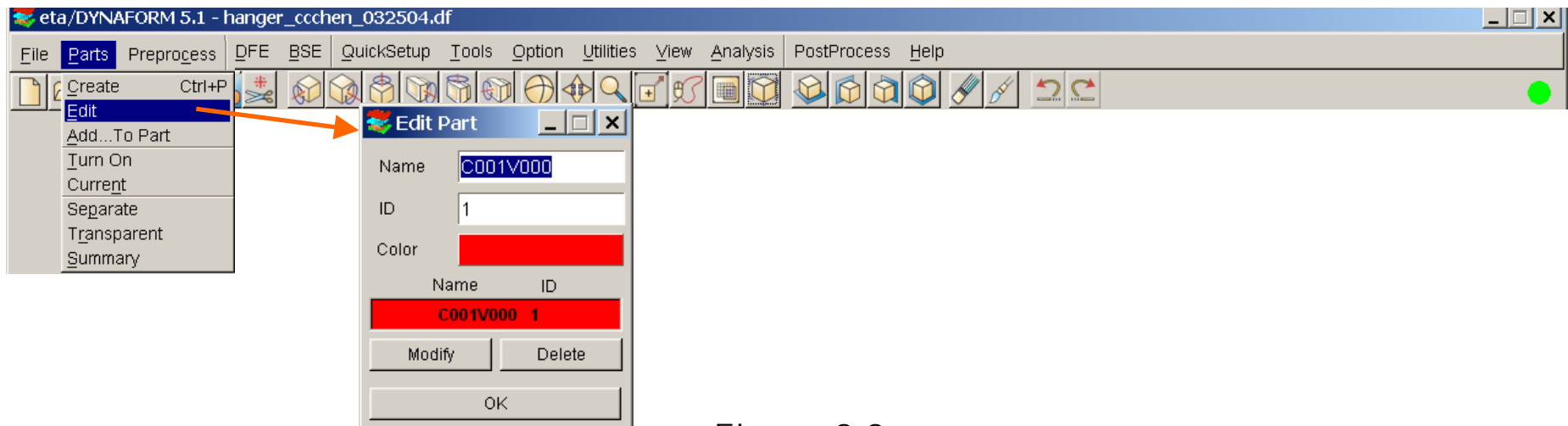



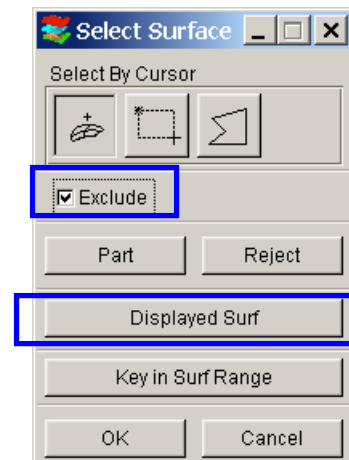
Figure 2.3

iv. Auto-Meshing the surfaces

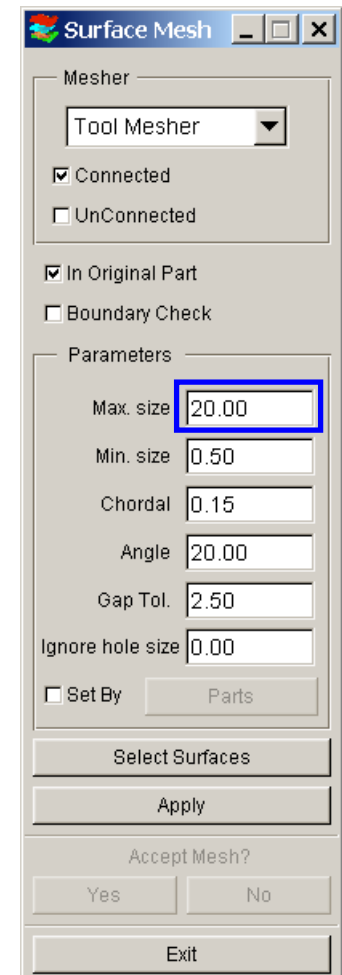
- a) Select **TOOL MESH** (See Figure 2.2a)
- b) Click **Displayed Surf.** to highlight all surfaces
- c) Toggle on “**Exclude**” (See Figure 2.2b)
- d) Select binder surfaces (See Figure 2.3a)
- e) Click **OK** to accept surfaces
- f) Select **Tool Mesher** (See Figure 2.2c)
- g) Key in Max. Size, **20.00** (mm)
- h) Click on **Apply**
- i) Click **Yes** to accept mesh
- j) Click **Exit** to dismiss Surface Mesh dialog window
- k) See Figure 2.3b
- l) Click on  to save the database



(a)



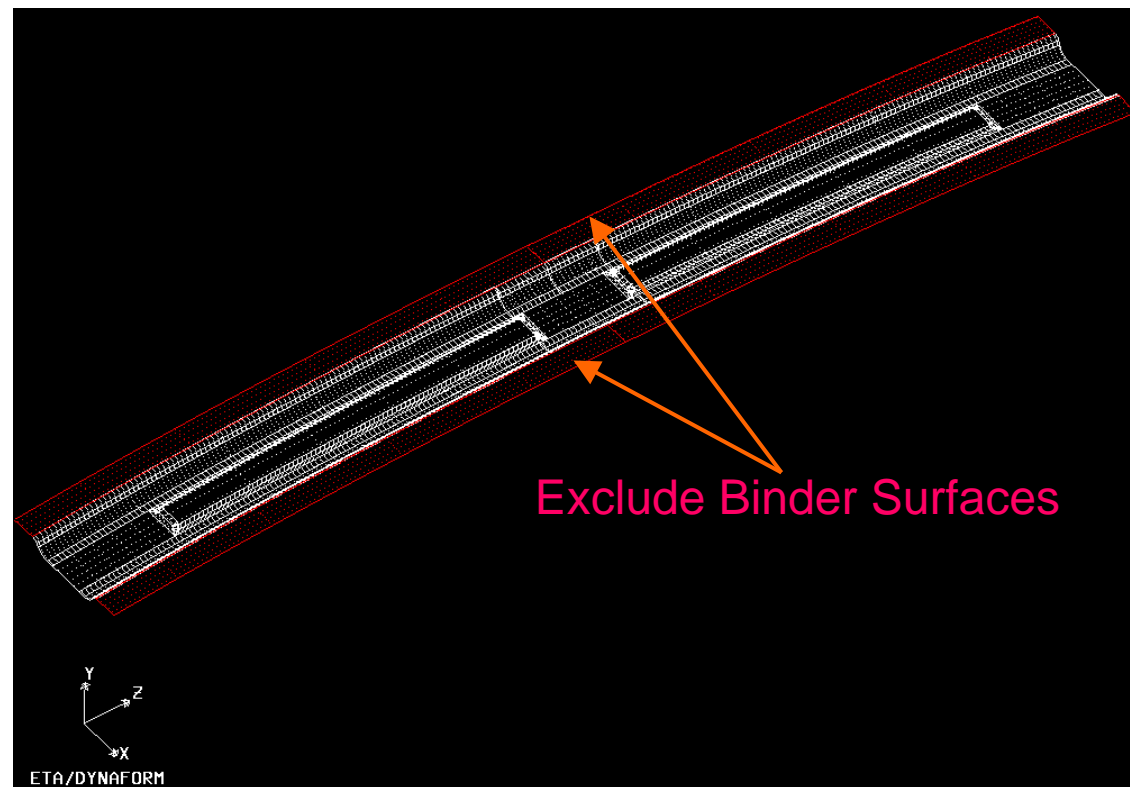
(b)



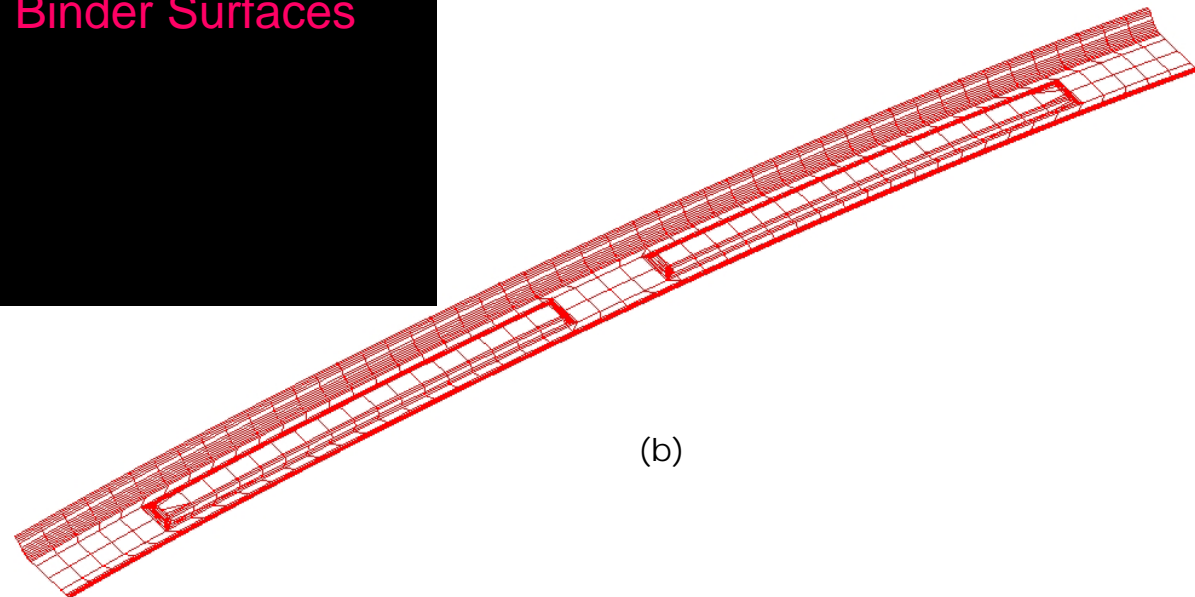
(c)

Figure 2.2

Tutorial II



(a)




(b)

Figure 2.3

Tutorial II

v. Check and repair meshes

- Select **MODEL CHECK** (See Figure 2.4)
- Click **Boundary Display** icon (Icon R1C2)
- Click on  (Clear highlight) to refresh screen
- Click **Plate Normal** icon (Icon R2C2)
- Read message window to make sure all normal is consistent
- Click **OK** to dismiss Model Check dialog window

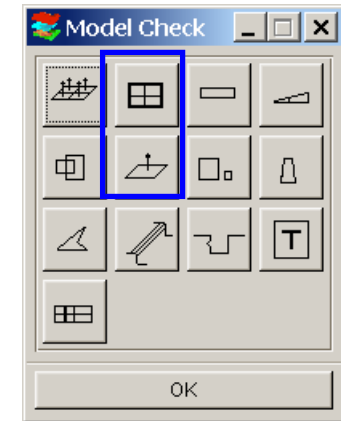


Figure 2.4

vi. Tipping

- Select **TIPPING**
- Click **Yes** to assign the current part as Die (see Figure 2.5)
- Toggle on “**Undercut**” (as shown in Figure 2.6)
- Key in rotation angle, **90°**
- Click **U+** to rotate the Die along U-axis by 90°
- See Figure 2.7
- Click **Exit** to dismiss Tipping dialog window
- Click **Exit** to dismiss DFE Preparation dialog window

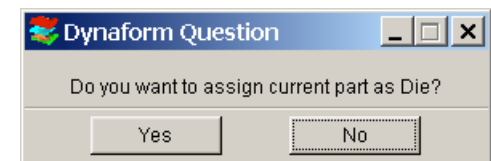


Figure 2.5

Tutorial II

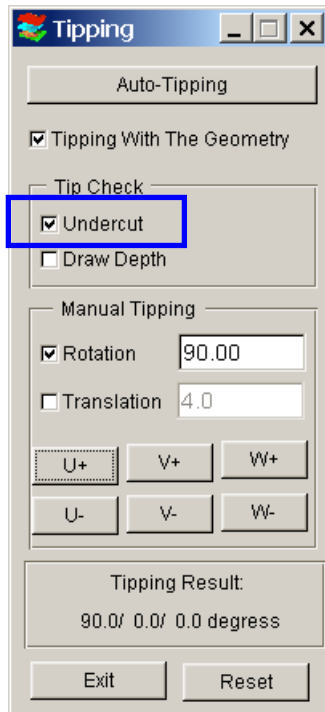
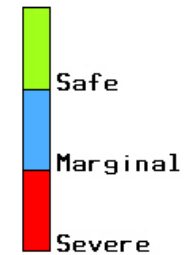
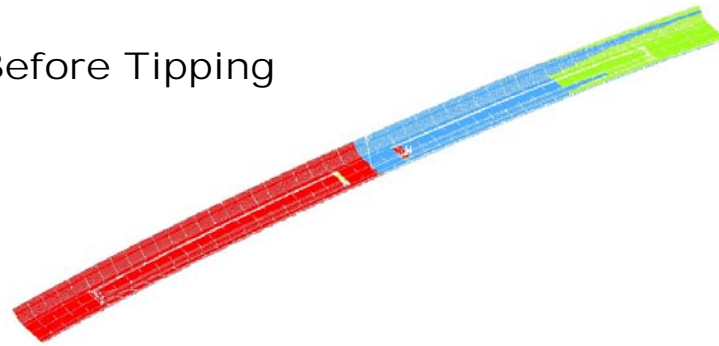


Figure 2.6

Before Tipping



After Tipping

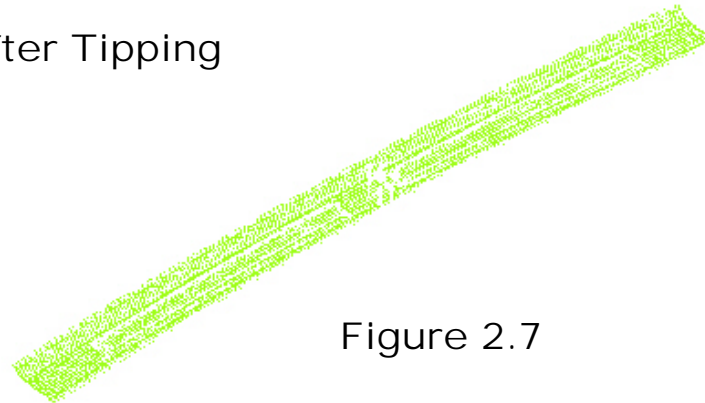


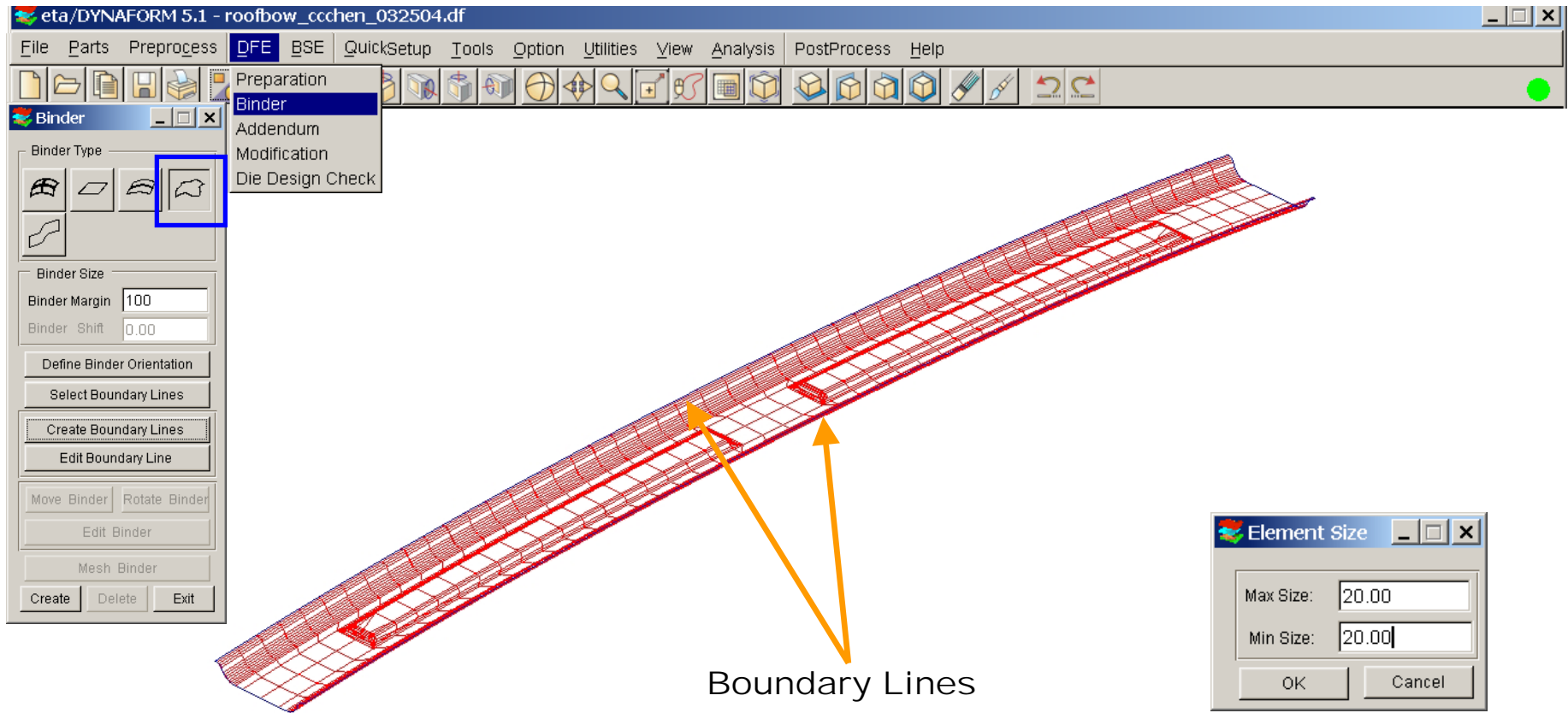


Figure 2.7

vii. Create Boundary Line Binder

- a) Click on  to display isometric view
- b) Click **DFE** (See Figure 2.8)
- c) Select **Binder**
- d) Select Binder Type: **Boundary Lines Binder**
- e) Key in Binder Margin, **100.00** (mm)
- f) Click **Define Binder Orientation**
- g) Click **MMB** (Middle Mouse Button)
- h) Click **Create Boundary Lines**
- i) Click **Select Boundary Lines**
- j) Select 2 boundary lines as shown in Figure (2.8)
- k) Click **OK** to accept selected boundary lines
- l) Click **Create** to generate binder
- k) Click **Mesh Binder**
- l) Key in Max and Min Size, **20.00** (mm) (See Figure 2.9)
- m) Click **OK**
- n) Click **Exit** to dismiss Binder dialog window
- o) Click on  to save the database

Tutorial II



Tutorial II

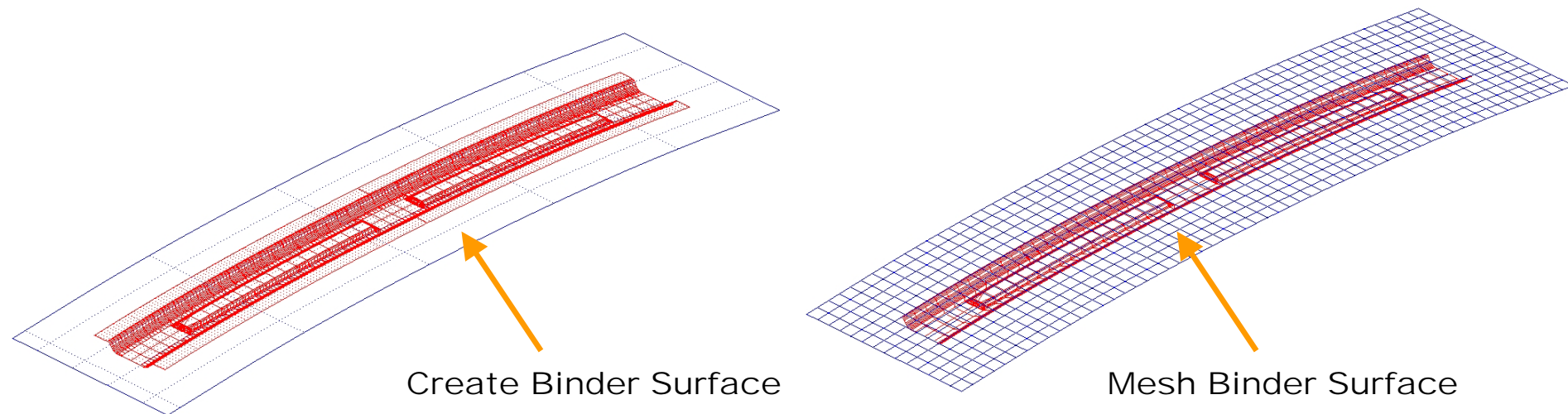


Figure 2.10

viii. Create master profile

- a) Click on *DFE*
- b) Select *Addendum*
- c) Click **New** (Master Profiles) (See Figure 2.11)
- d) Select Profile Type **#2**
- e) Key in Die Radius, **6.00** (mm)
- f) Key in Part Radius, **12.00** (mm)
- g) Click **Apply**
- h) Click **Ok** to dismiss Master Profile dialog window

Tutorial II

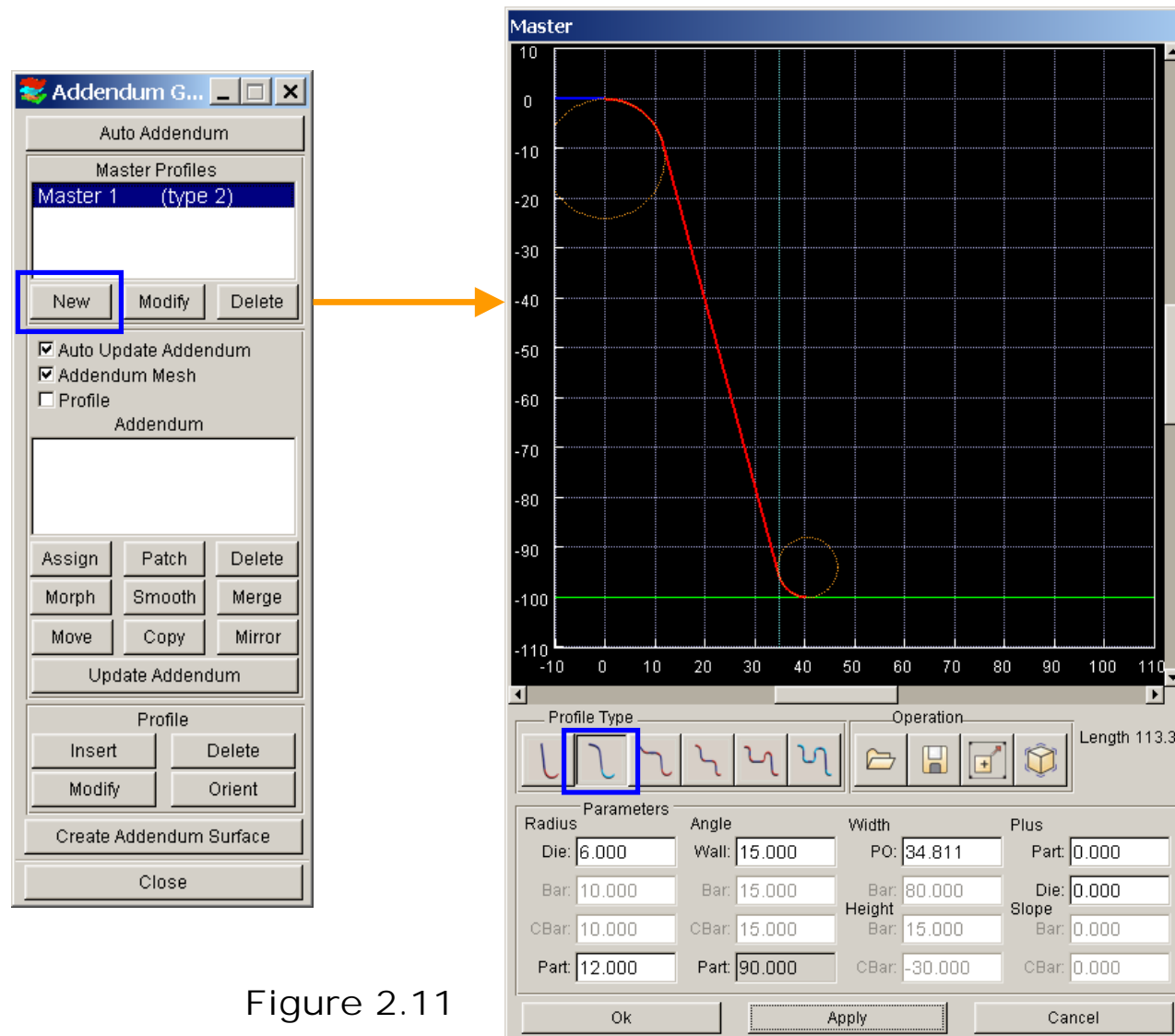
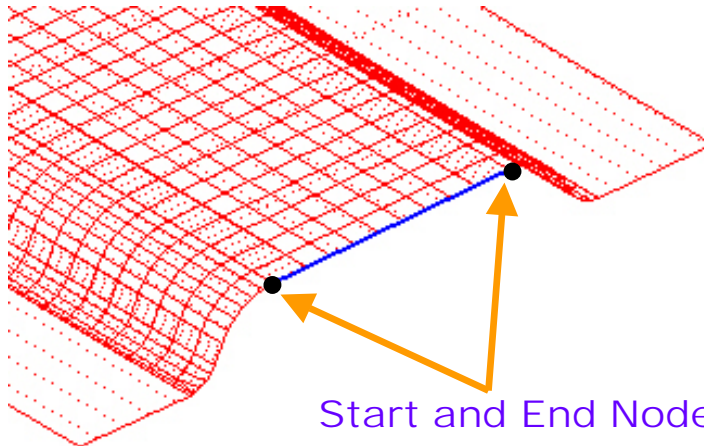


Figure 2.11

ix. Insert addendum

- Click **Assign** (Addendum) (See Figure 2.12)
- Toggle on “By Segment”
- Click **Select Region**
- Pick two nodes on die boundary as starting and end point for boundary segment (See Figure 2.13)
- Click **Yes** to accept marked region



Select Boundary Segment

Figure 2.13

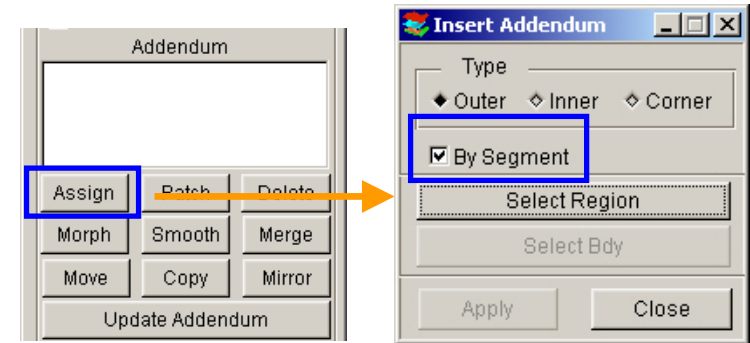
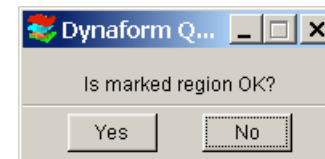


Figure 2.12



Tutorial II

Insert addendum continue ...

- f) Click **Apply**
- g) Repeat steps (c) to (f) to insert addendum for the other end of the die
- h) Click **Close** to dismiss Insert Addendum dialog window
- i) See Figure 2.14

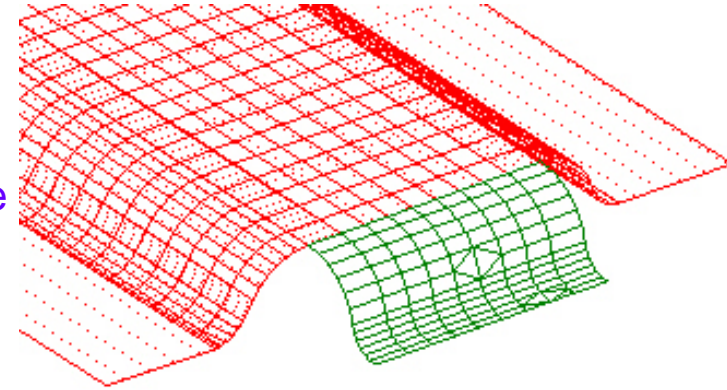


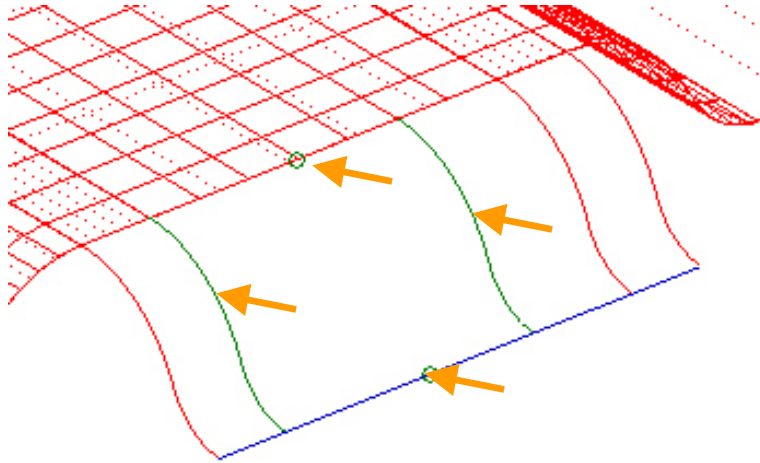
Figure 2.14

x. Insert profile

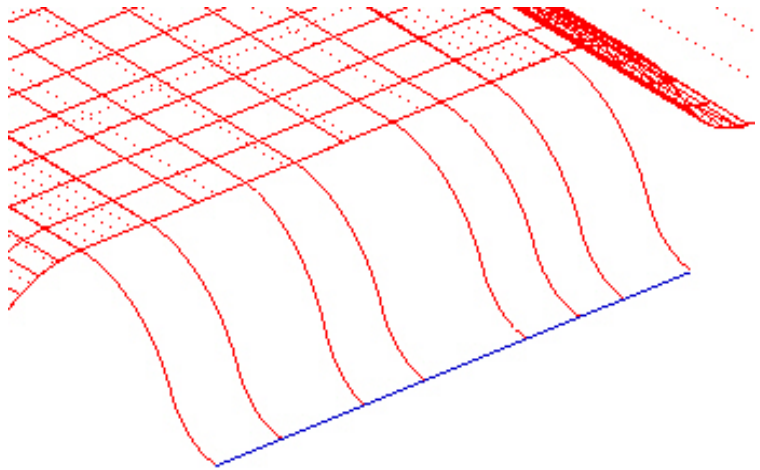
- a) Click **Insert** (Profile)
- b) Select two adjacent profiles to define segment (See Figure 2.15a)
- c) Pick a node on die boundary
- d) Pick a point of POP line
- e) Click **Ok**
- f) Repeat steps (b) to (e)
- g) Click **MMB** (See Figure 2.15b)

Tutorial II

(a)

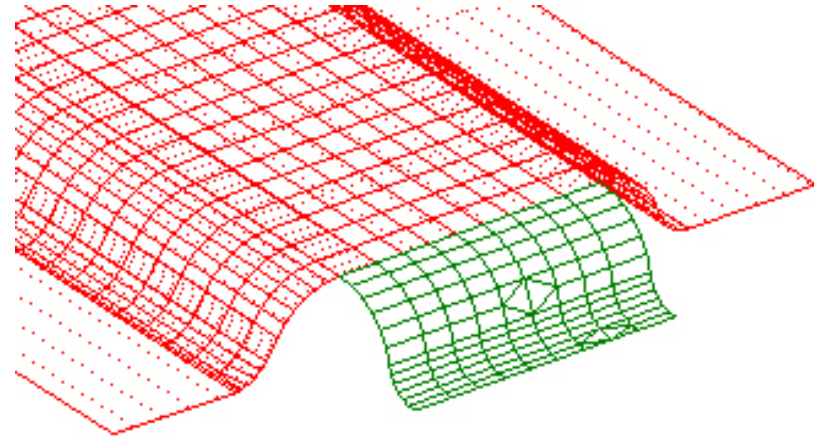


Define location

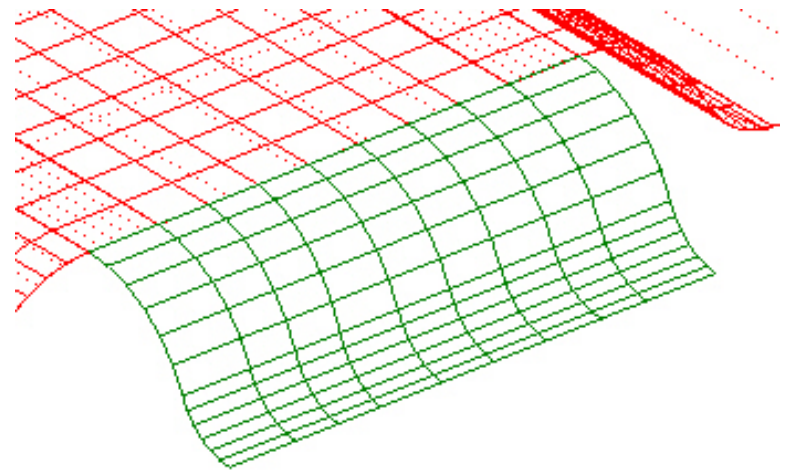


Insert Individual Profile

(b)



Before insert profile



After insert profile


Figure 2.15

Tutorial II

xi. Create corner addendum

- Click **Insert** (Addendum)
- Toggle on “**Corner**”
- Click **Select Bdy** (See Figure 2.16)
- Select end profile (See Figure 2.17)
- Select two nodes on the boundary
- Click **Yes** to accept defined region
- Click **Apply**
- Click **Yes** to accept result
- Repeat steps (c) to (h)
- Click **Close** to dismiss Insert Addendum dialog window
- See Figure 2.17

xii. Create addendum surface

- Click **Create Addendum Surface**
- Click **Close** to dismiss Addendum Generation dialog window
- See Figure 2.18
- Click on  to save the database

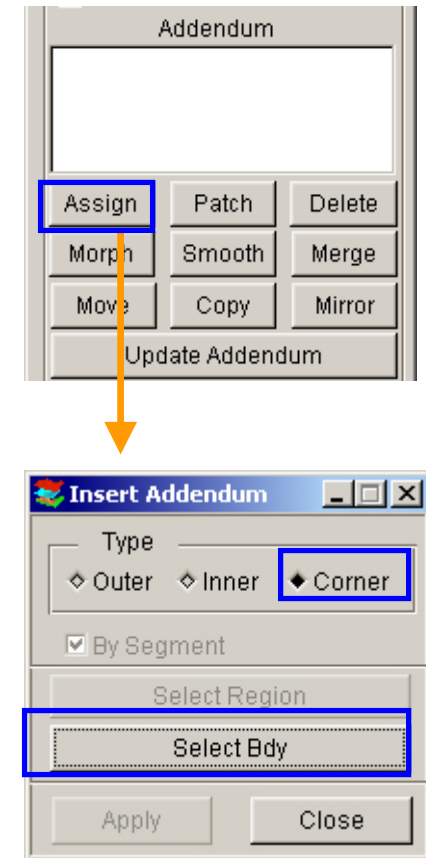


Figure 2.16

Tutorial II

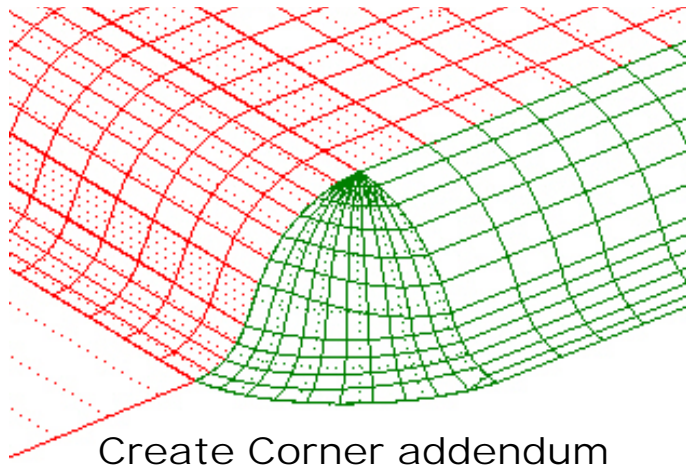
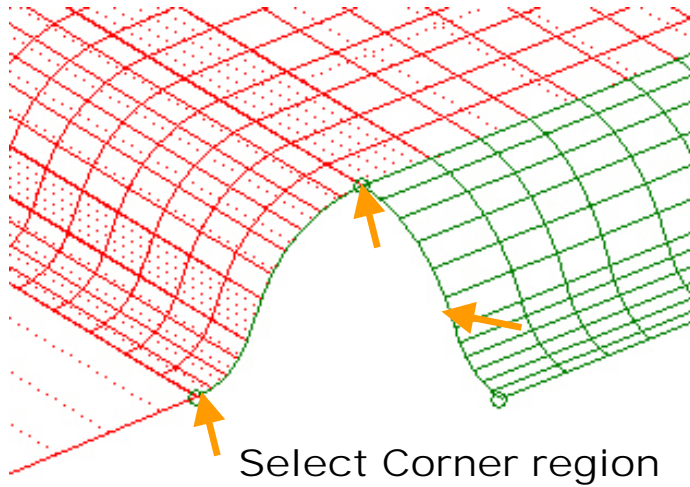


Figure 2.17

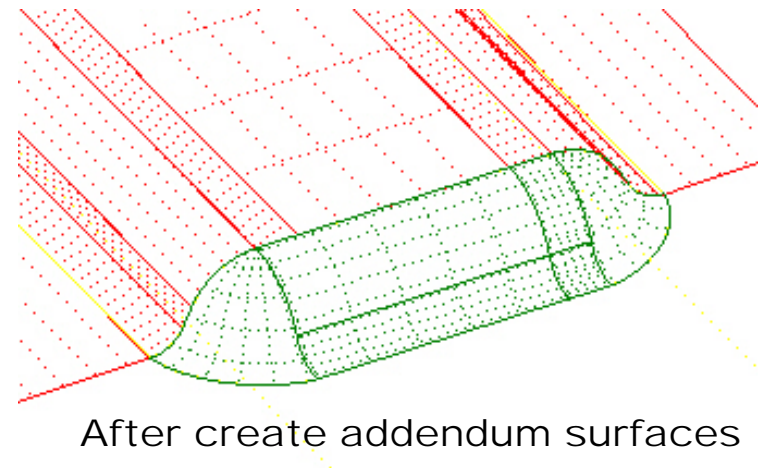
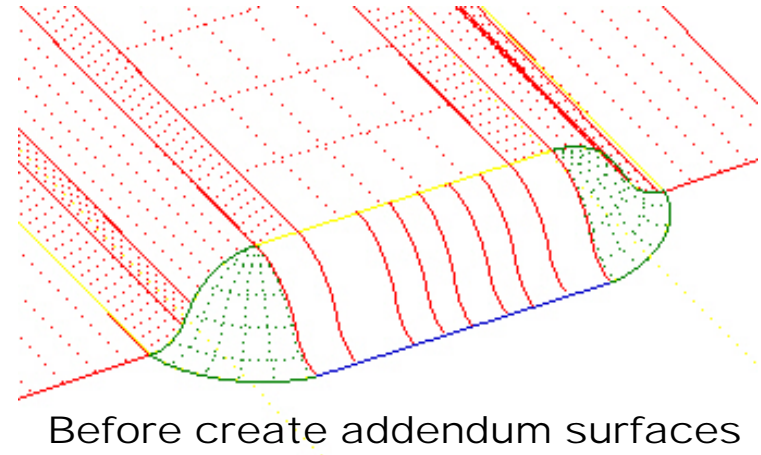



Figure 2.18

xiii. Binder trimming

- a) Click **DFE**
- b) Select **Modification**
- c) Select **BINDER TRIM** (See Figure 2.19a)
- d) Toggle off “Surface”
- e) Click **Select** (See Figure 2.19b) to select trimline as shown in Figure 2.20a
- f) Click **Ok** to confirm the selection
- g) Click **Apply**
- h) Click **Yes** to accept the displayed line for binder trimming
- i) Click **Close** to dismiss Complete Binder dialog window
- j) Click on  to save the database
- k) Turn off all parts and turn on **C_BINDER** (See Figure 2.20b)

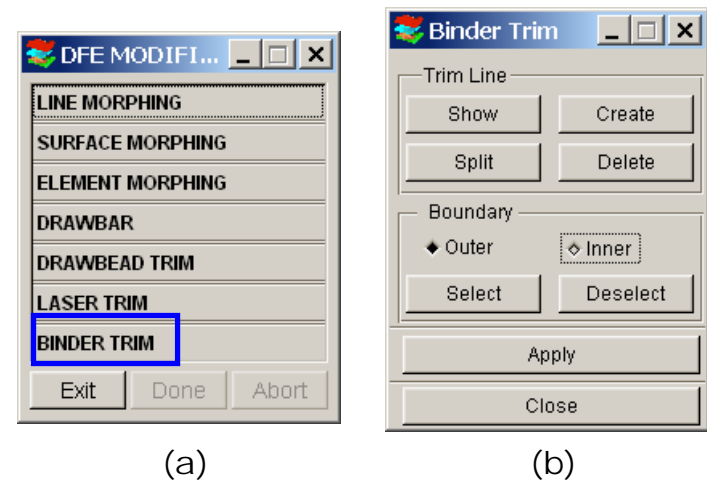


Figure 2.19

Tutorial II

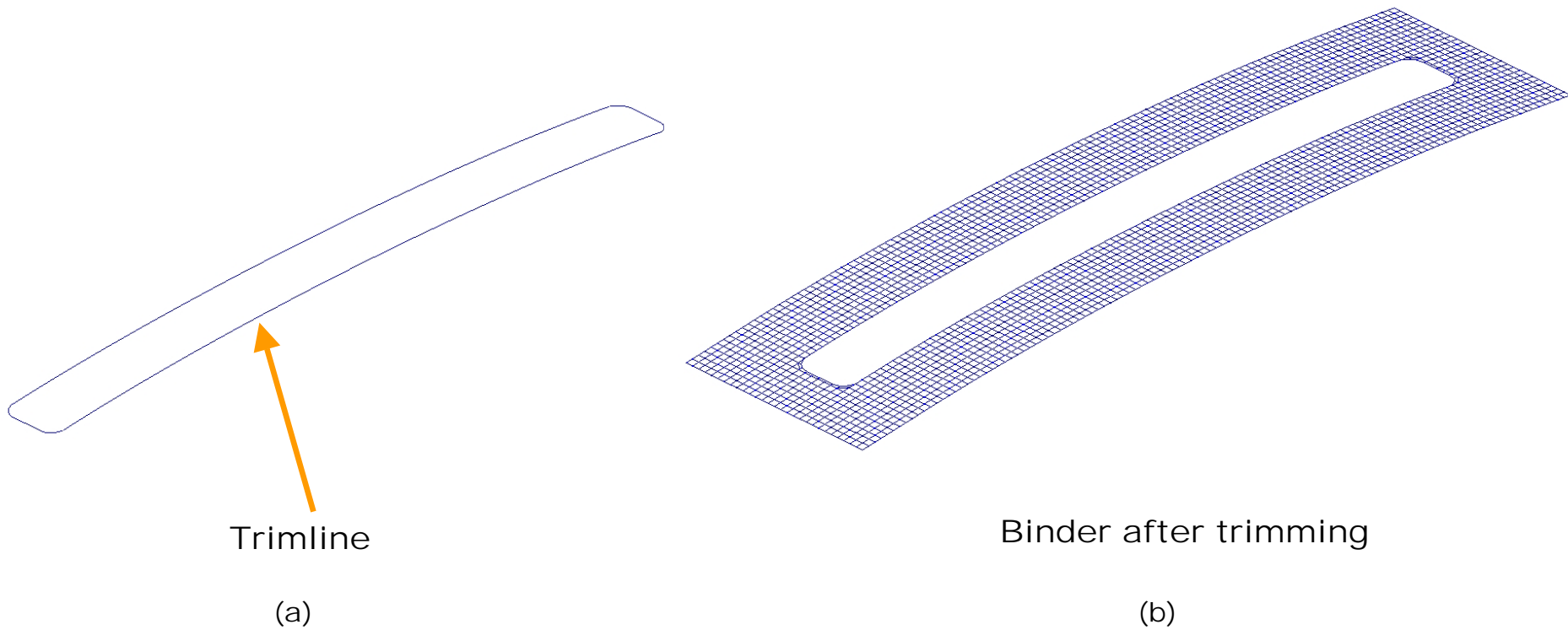


Figure 2.20

Tutorial II

xiv. Generate trimline for Direct Trim application

- a) Click *Preprocess*
- b) Select *Surface*
- c) Turn on part ROOFBOW
- d) Click on **Create BDY Line** (Icon R3C4) (See Figure 2.21)
- e) Select the flange surface (See Figure 2.22)
- f) Click **OK**
- g) Click **OK** to dismiss the Surface dialog window



Figure 2.21

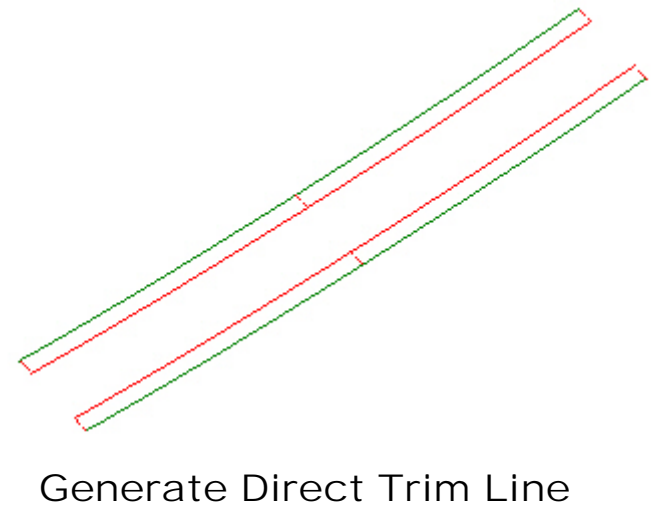
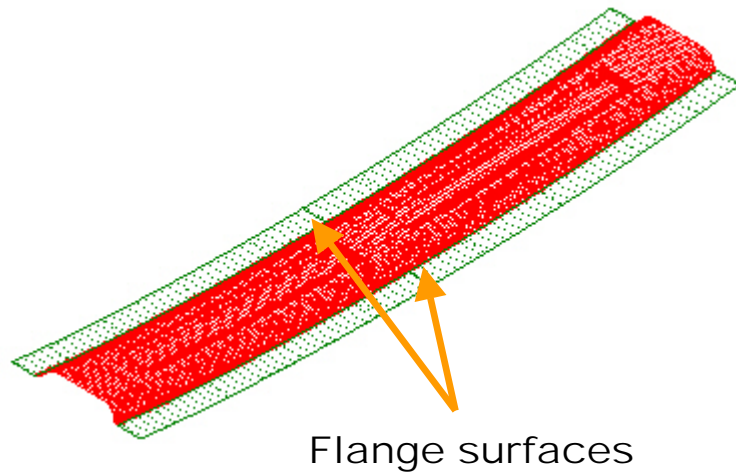


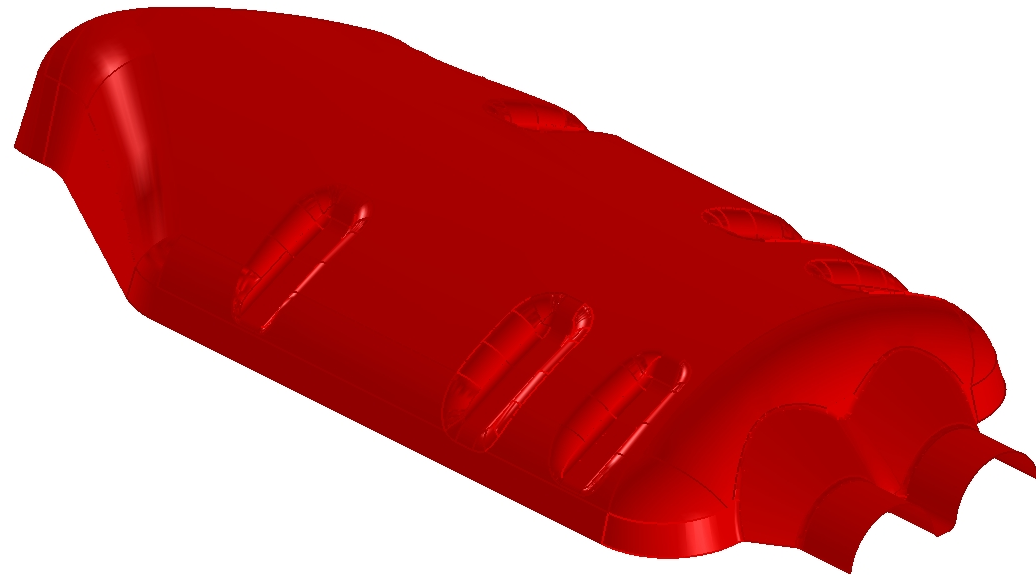
Figure 2.22

Tutorial III

Exhaust Muffler to show Flat Binder, CAM trim


Exhaust Manifold DFE procedures :

- i. Open and save database
- ii. Importing part geometry
- iii. Rename part
- iv. Auto-Meshing the surfaces
- v. Check and repair meshes
- vi. Assign tooling
- vii. Create Flat Binder
- viii. Create master profile
- ix. Insert addendum
- x. Modify profile orientation
- xi. Create addendum surface
- xii. Binder trimming
- xiii. Generate trimline for CAM Trim application



Exhaust Muffler

i. Open and save database

- a) Click on  to create a new database
- b) Click **Yes** to save the database
- c) Click on *File* and select *Save As ...*
- c) Type in “exhaust_(user name)_(date).df” as File Name
- d) Click on **Save**

ii. Import part geometry

- a) Click on *DFE* (See Figure 3.1)
- b) Select *Preparation*
- c) Click **IMPORT**
- d) Select File location: .../Tutorial3_ExhaustMuffler
- e) Pick File name: exhaust_muffler.igs
- f) Click **Ok** to import the part geometry

Tutorial III

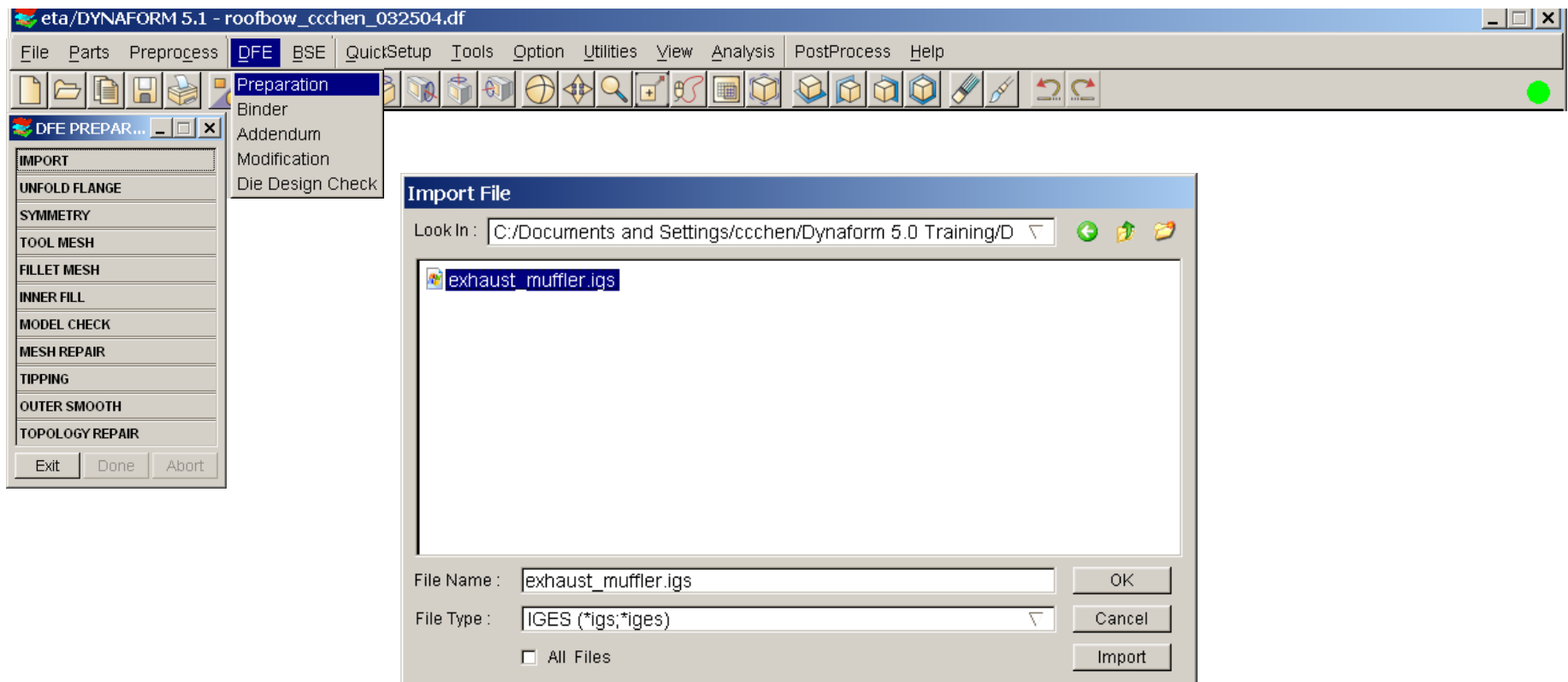


Figure 3.1

Tutorial III

iii. Rename Part

- Click on **Parts** (See Figure 3.3)
- Select **Edit**
- Double click on the input box for Name to highlight Part C001V000
- Type in “EXHAUST”
- Click **Modify**
- Click **OK** to dismiss Edit Part dialog window

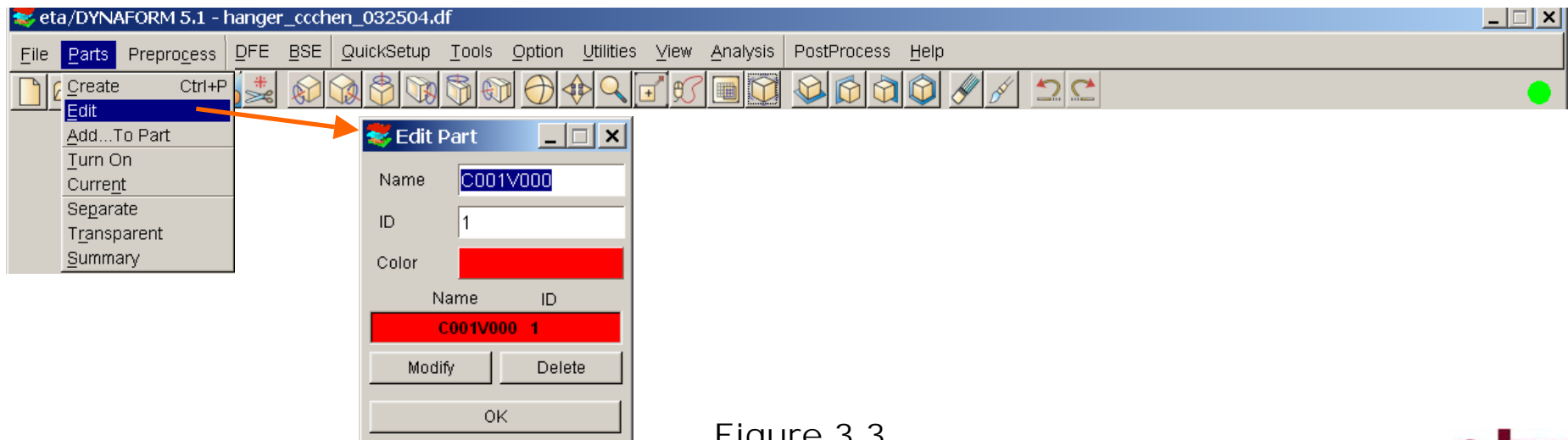

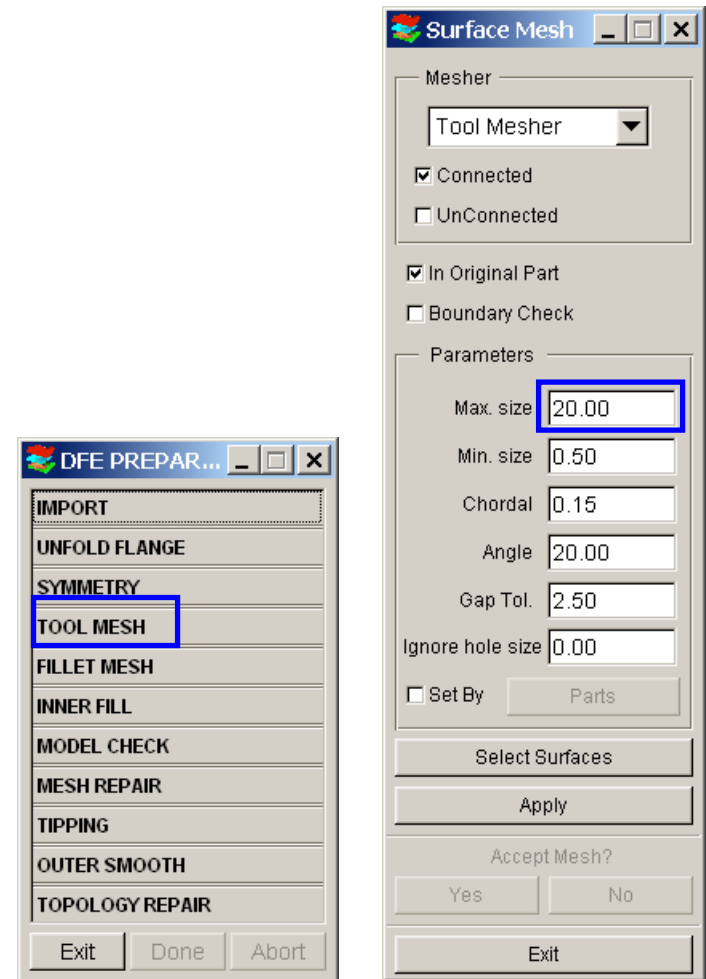


Figure 3.3

Tutorial III

iv. Auto-Meshing the surfaces

- a) Select **TOOL MESH** (See Figure 3.2a)
- b) Click **Displayed Surf.** to highlight all surfaces
- c) Select binder surfaces (See Figure 3.3)
- d) Click **OK** to accept surfaces
- e) Select **Tool Mesher** (See Figure 3.2b)
- f) Key in Max. Size, **20.00** (mm)
- g) Click on **Apply**
- h) Click **Yes** to accept mesh
- i) Click **Exit** to dismiss Surface Mesh dialog window
- j) See Figure 3.3
- k) Click on  to save the database



(a)

(b)

Figure 3.2

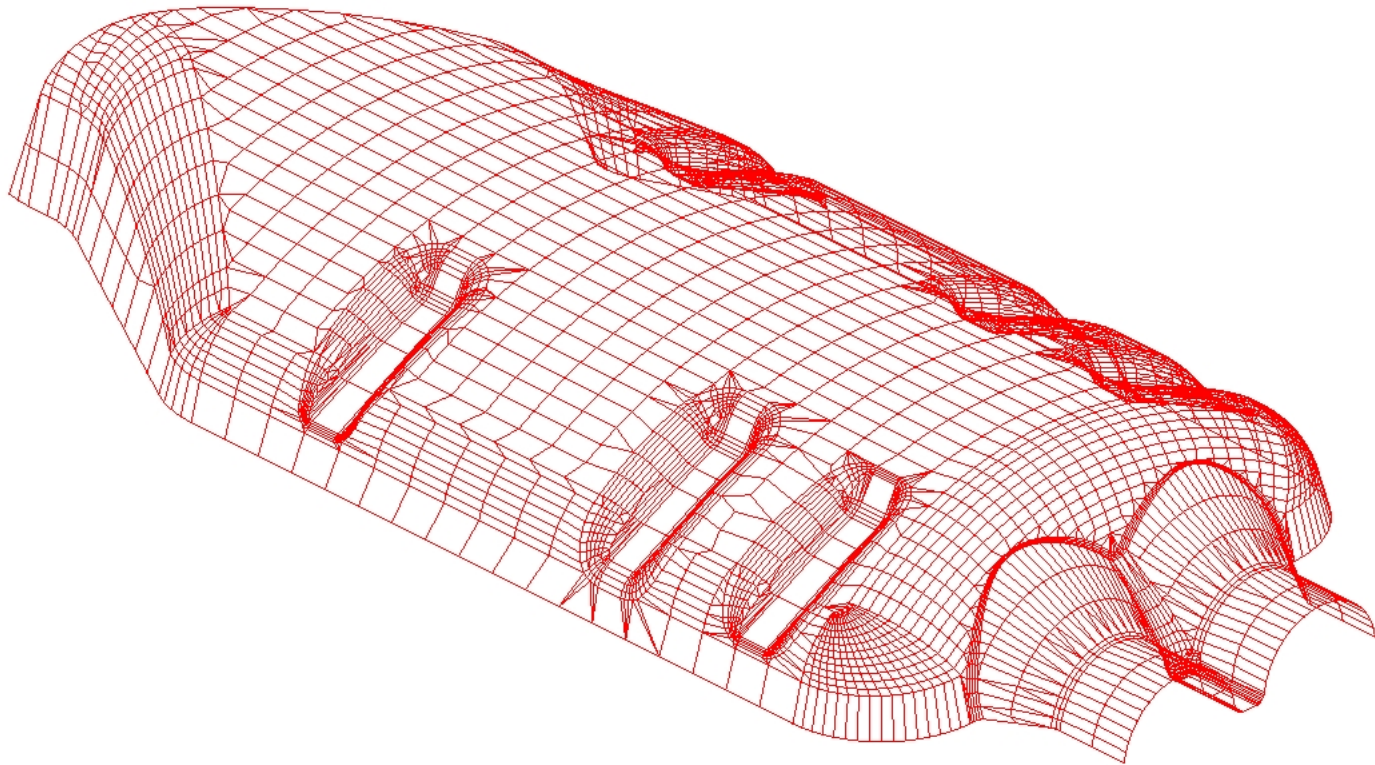



Figure 3.3

Tutorial III

v. Check and repair meshes

- a) Select **MODEL CHECK** (See Figure 3.4)
- b) Click **Boundary Display** icon (Icon R1C2)
- c) Click on  (Clear highlight) to refresh screen
- d) Click **Plate Normal** icon (Icon R2C2)
- e) Read message window to make sure all normal is consistent
- f) Click **OK** to dismiss Model Check dialog window

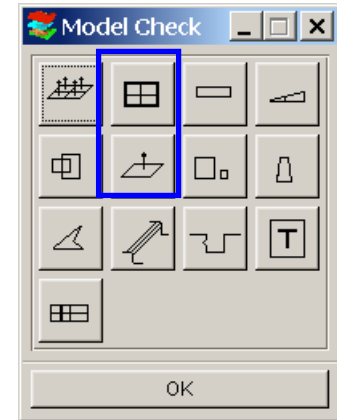



Figure 3.4

vi. Assign tooling

- a) Click *Tools*
- b) Select *Define Tools*
- c) Click **ADD** to assign **EXHAUST** as Die (See Figure 3.5)
- d) Pick **EXHAUST** from the list
- e) Click **OK** to confirm selection
- f) Click **OK** to dismiss Define Tools dialog window

Tutorial III

vii. Create Flat Binder

- a) Click **DFE**
- b) Select **Binder** (See Figure 3.6a)
- c) Select Binder Type: **Flat Binder**
- d) Key in Binder Margin, **120.00** (mm)
- e) Key in Binder Shift, **8.00** (mm)
- f) Click **Define Binder Orientation**
- g) Click **MMB** (Middle Mouse Button)
- h) Click **Create** to generate binder
- i) Click on  (Fill screen) to display all the parts on screen
- j) Click **Mesh Binder**
- k) Key in Max and Min Element Size, **20.00** (mm)
- l) Click **OK**
- m) Click **Exit** to dismiss Binder dialog window
- n) See Figure 3.7

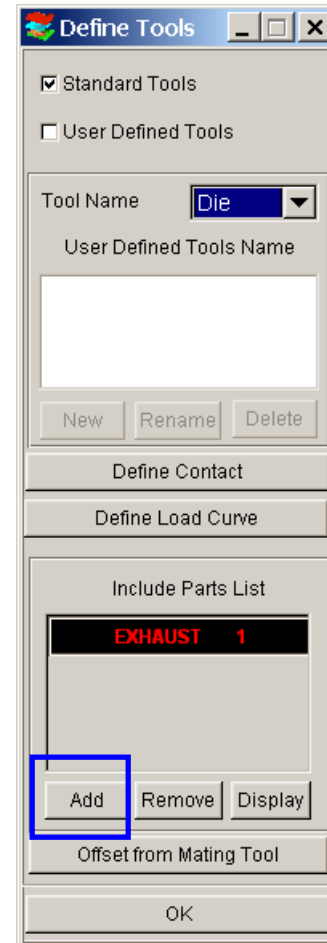
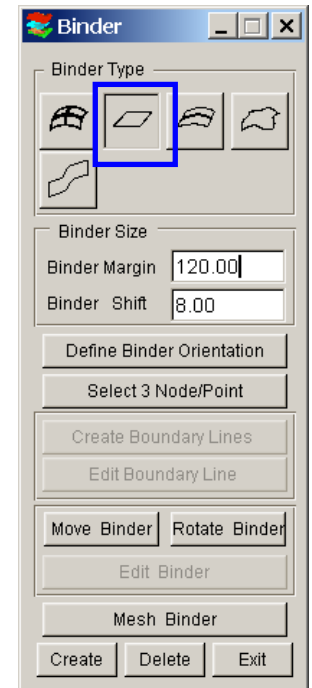
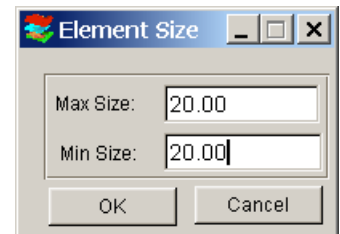


Figure 3.5



(a)



(b)

Figure 3.6

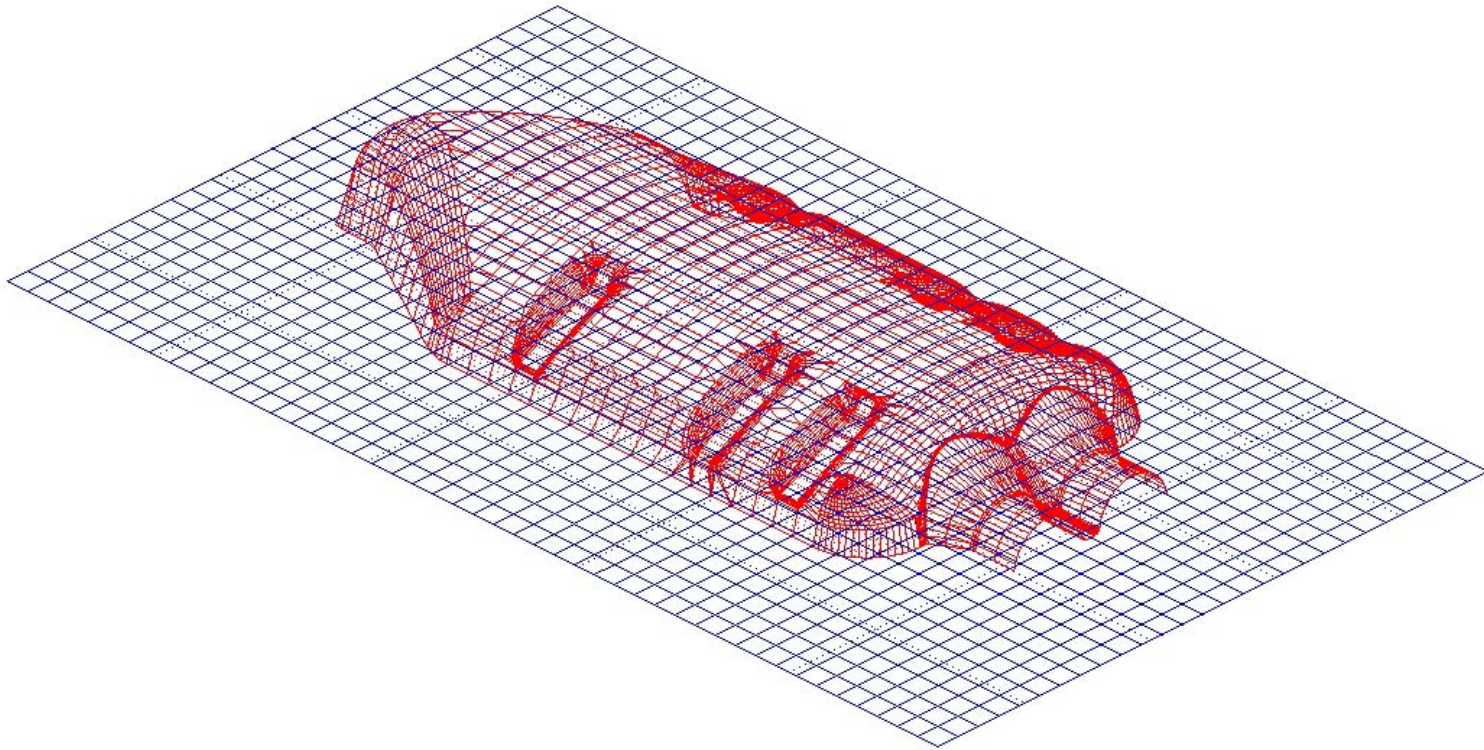


Figure 3.7

viii. Create master profile

- a) Click on *DFE*
- b) Select *Addendum*
- c) Click **New** (Master Profiles) (See Figure 3.8)
- d) Key in PO Width, **45.00** (mm)
- e) Click **Apply**
- f) Click **Ok** to dismiss Master Profile dialog window
- g) Click **New** (Master Profiles)
- h) Select Profile Type, **#1** (See Figure 3.9)
- i) Key in Die Radius, **12.00** (mm)
- j) Click **Apply**
- k) Click **Ok**

Tutorial III

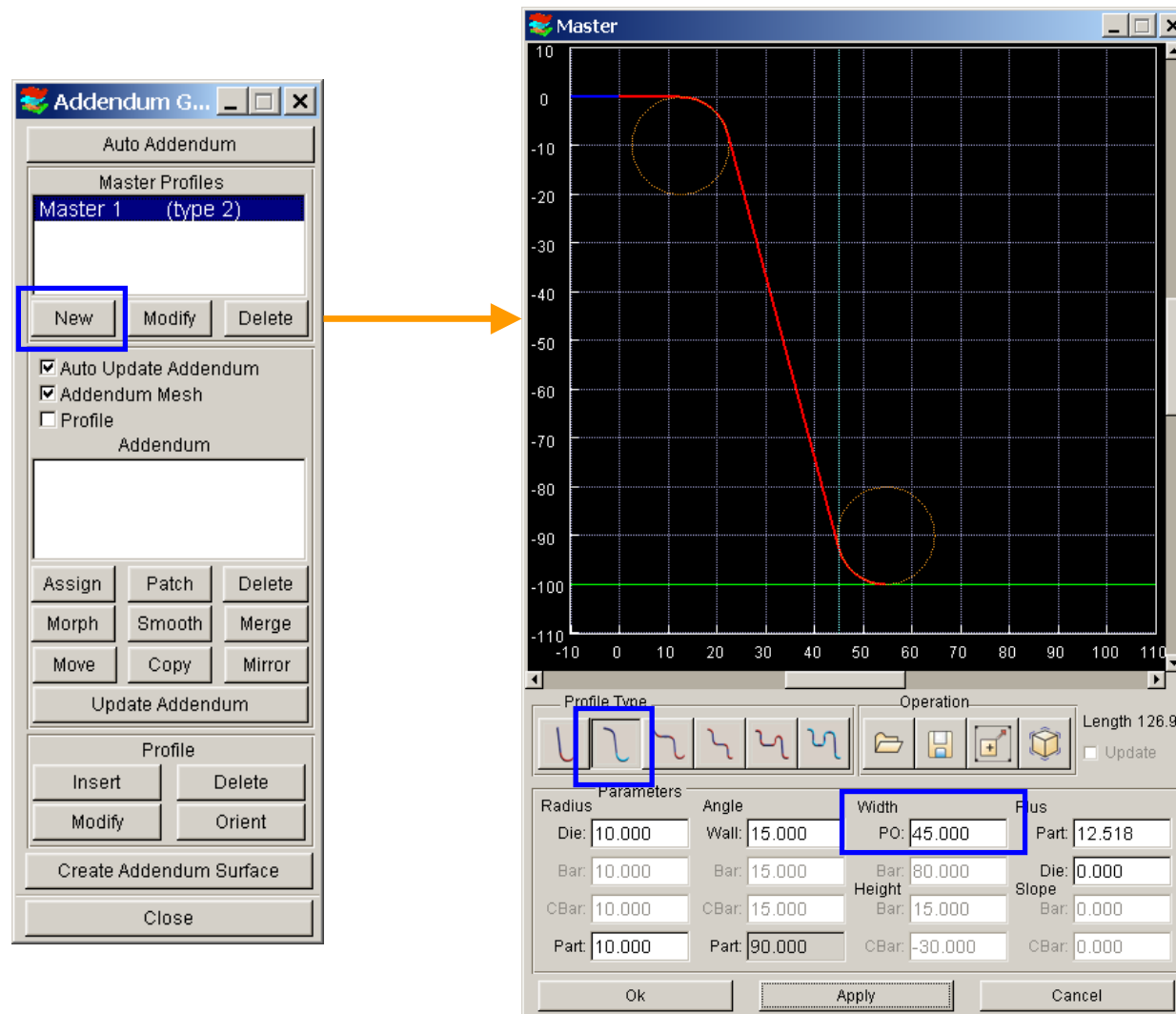


Figure 3.8

Tutorial III

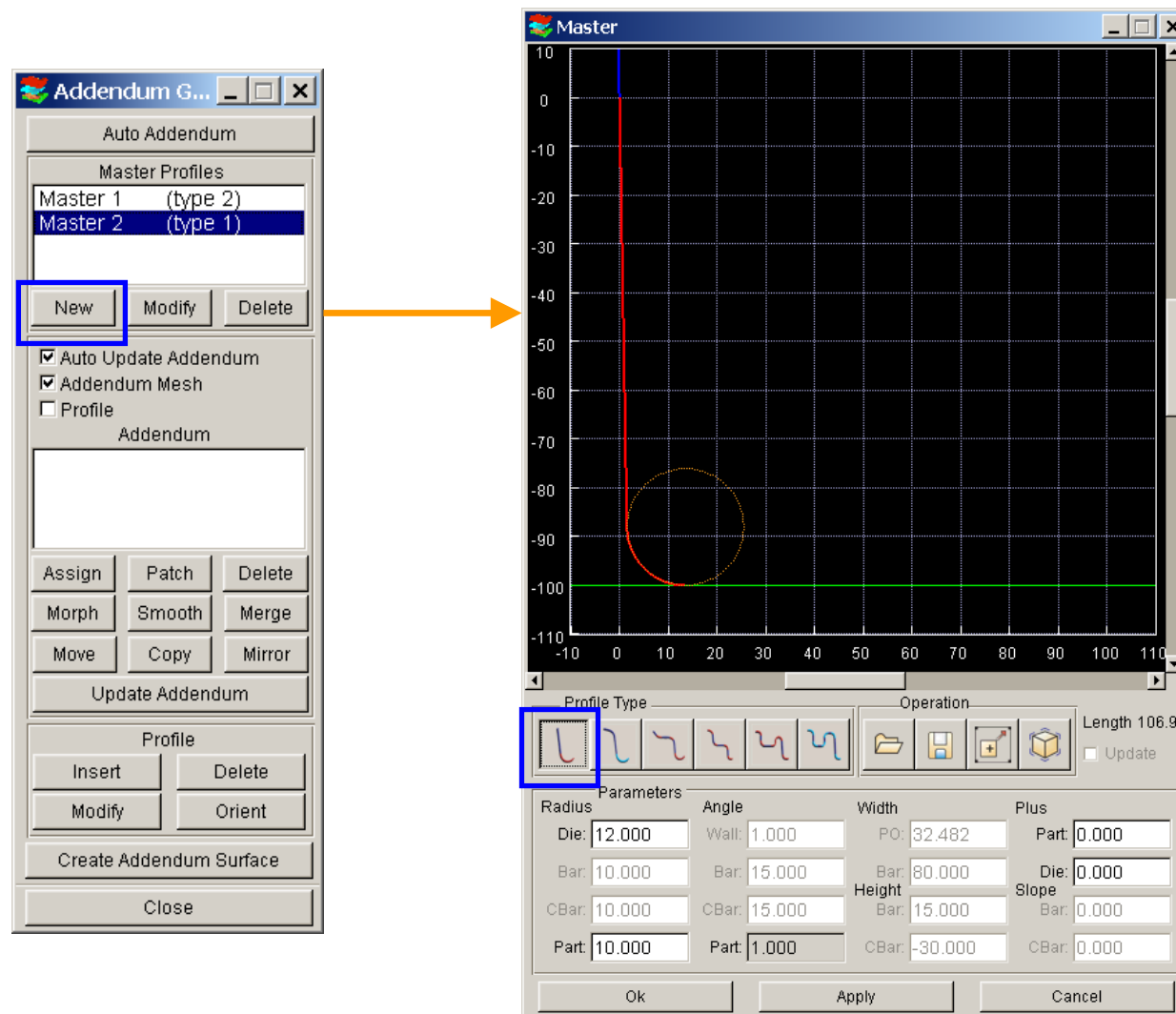





Figure 3.9

Tutorial III

ix. Insert addendum

- 1) Toggle off “Surface”
- 2) Select **Master 2** from Master Profiles list (See Figure 3.10)
- 3) Click **Assign** (Addendum) (See Figure 3.10)
- 4) Toggle on “By Segment”
- 5) Click **Select Region**
- 6) Click on  (Window zoom) to zoom in the region as shown in Figure 3.11a
- 7) Pick two nodes on die boundary to define segment as shown in Figure 3.11b
- 8) Click **Yes** to accept marked region
- 9) Click **Apply** to insert addendum segment
- 10) Click on  to zoom out all parts
- 11) Click on  to zoom in the region as shown in Figure 3.12a
- 12) Pick two nodes on the die boundary to define segment as shown in Figure 3.12b
- 13) Repeat steps (8) to (10)

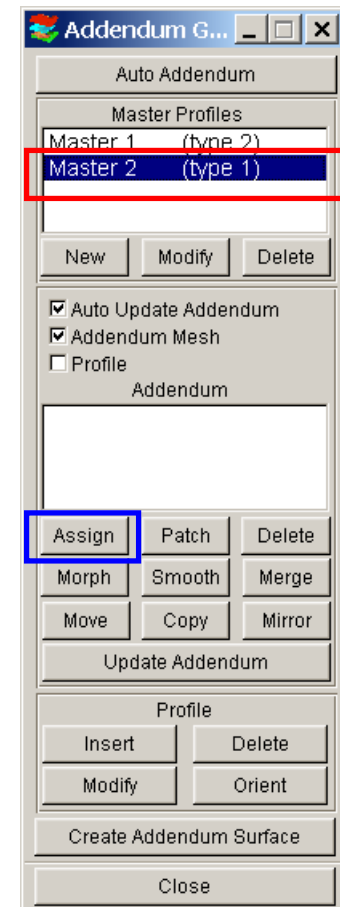
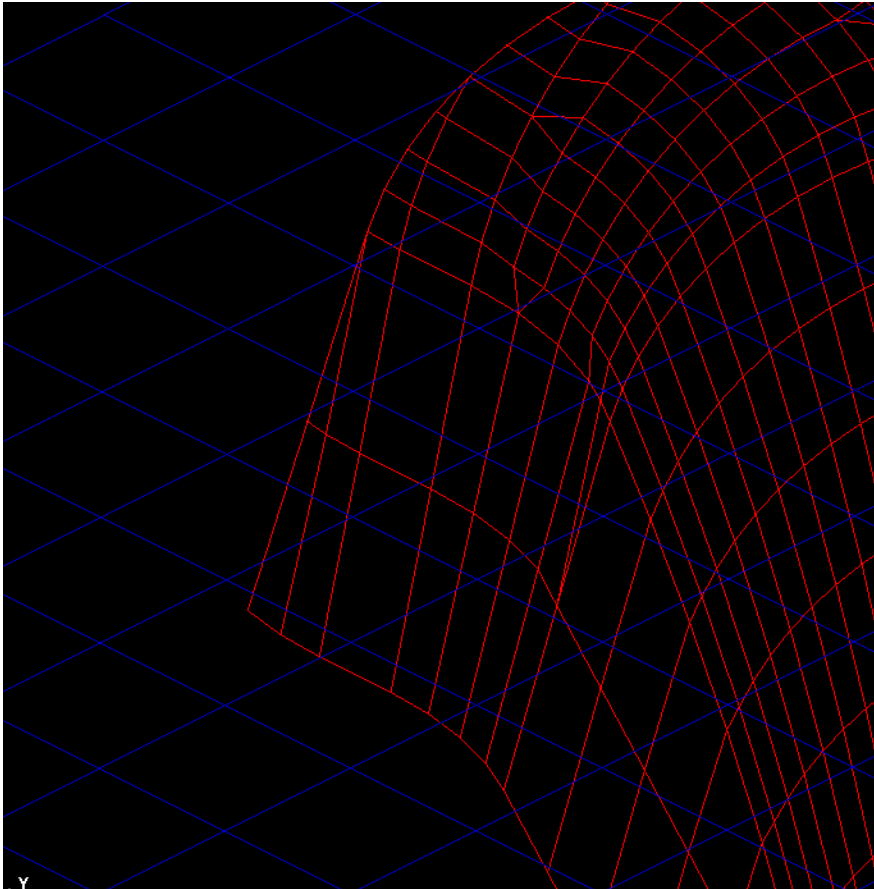
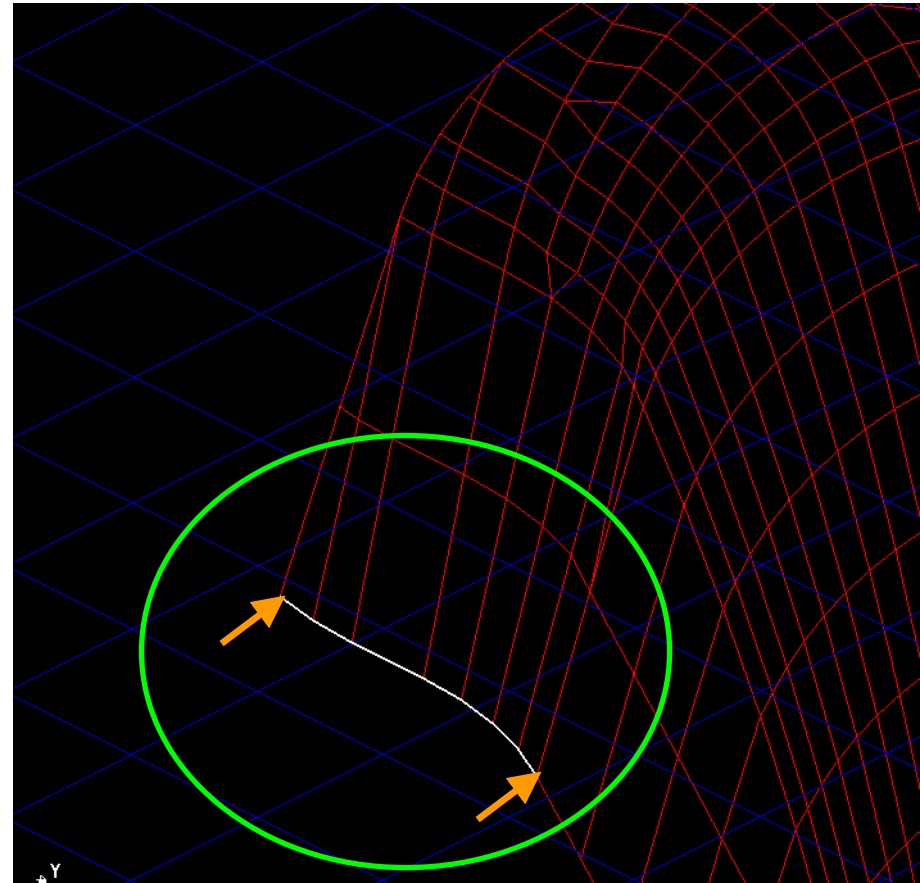


Figure 3.10

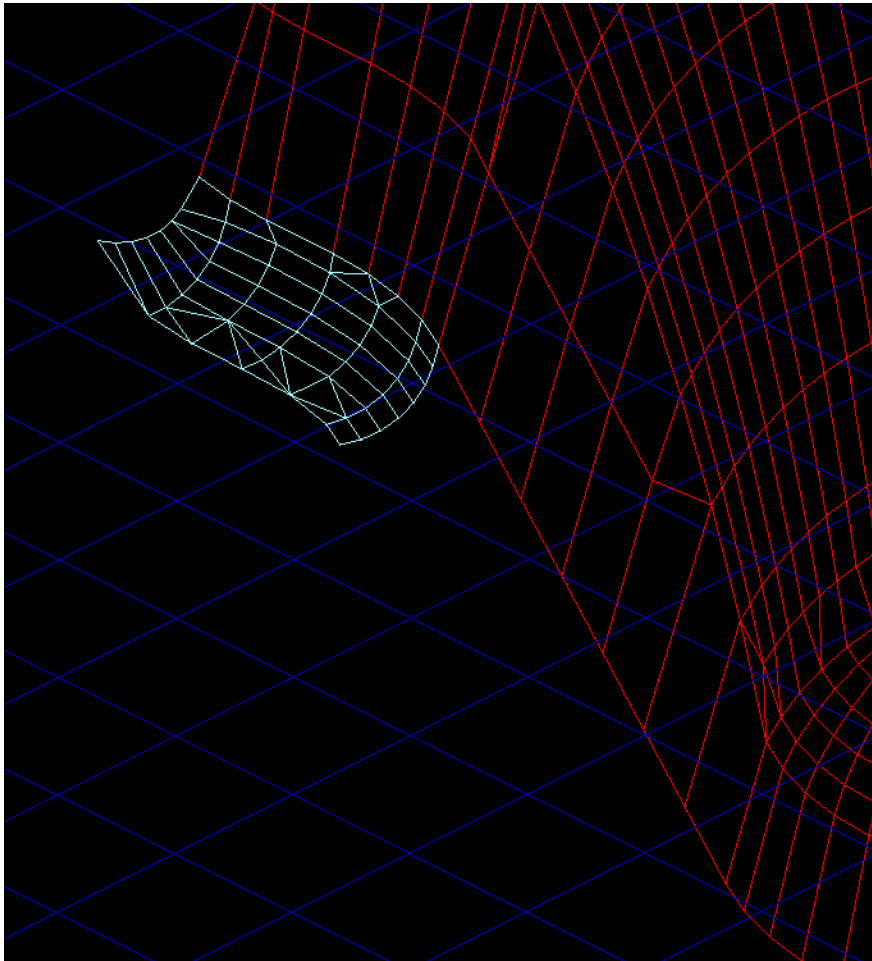


(a)

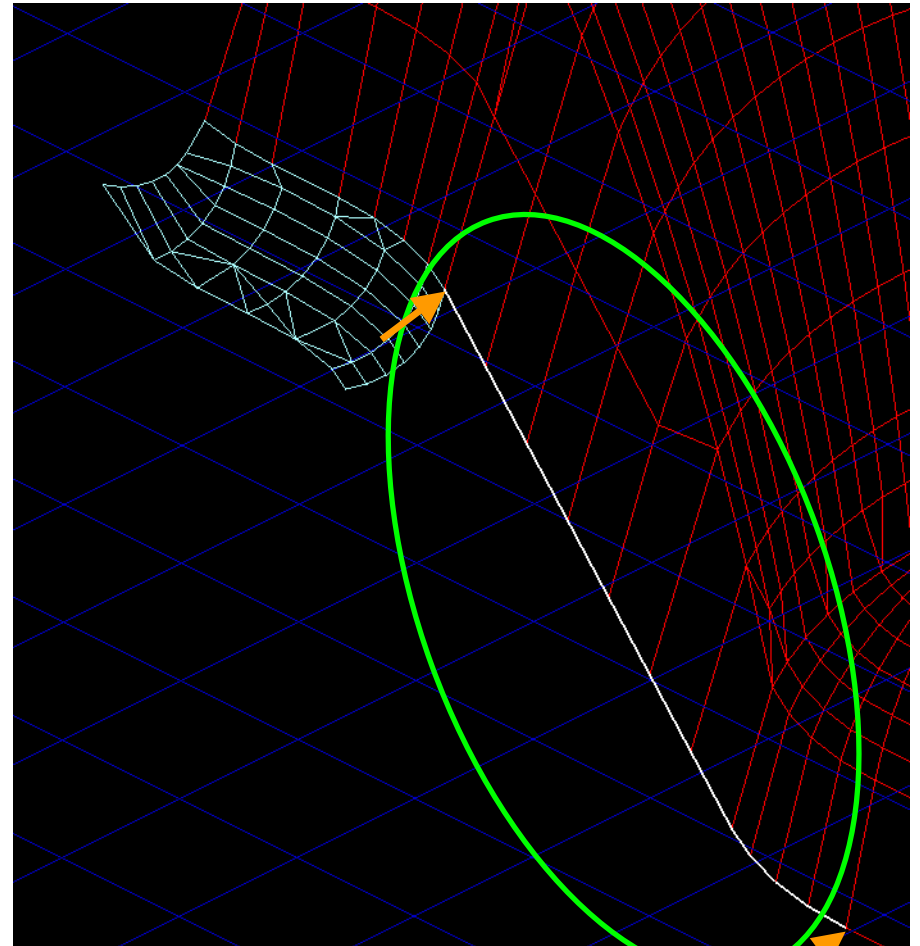


(b)

Figure 3.11



(a)




(b)

Figure 3.12

Tutorial III

Insert addendum continue ...

- 14) Click on  to display all parts
- 15) Click **Select Region**
- 16) Pick two nodes on die boundary to define segment as shown in Figure 3.13
- 17) Click **Yes** to accept marked region
- 18) Click **Apply** to insert addendum segment
- 19) Hold **Ctrl key** and click **LMB** (Left Mouse Button)
- 20) Rotate the model to the position as shown in Figure 3.14a
- 21) Release **Ctrl key** and **LMB**
- 22) Click **Select Region**
- 23) Pick two nodes on die boundary to define segment as shown in Figure 3.14b
- 24) Click **Yes** to accept marked region
- 25) Click **Apply** to insert addendum segment
- 26) Click **Close** to dismiss the dialog window

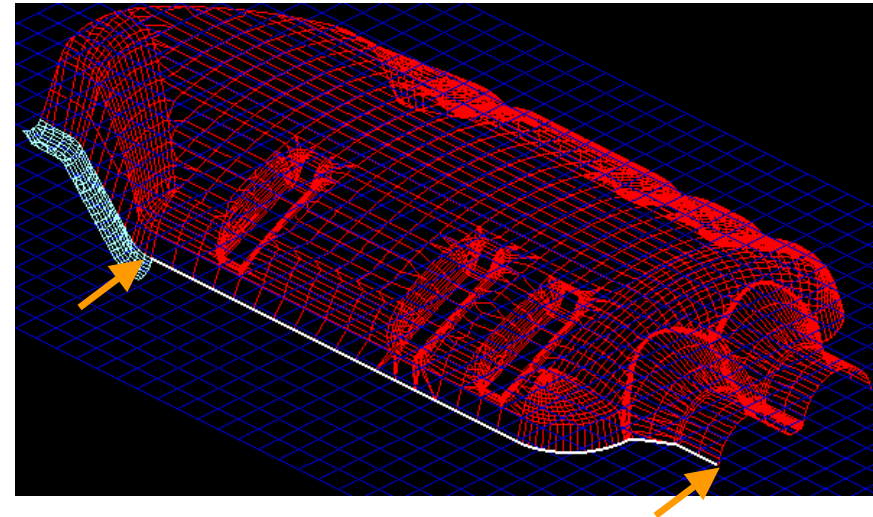
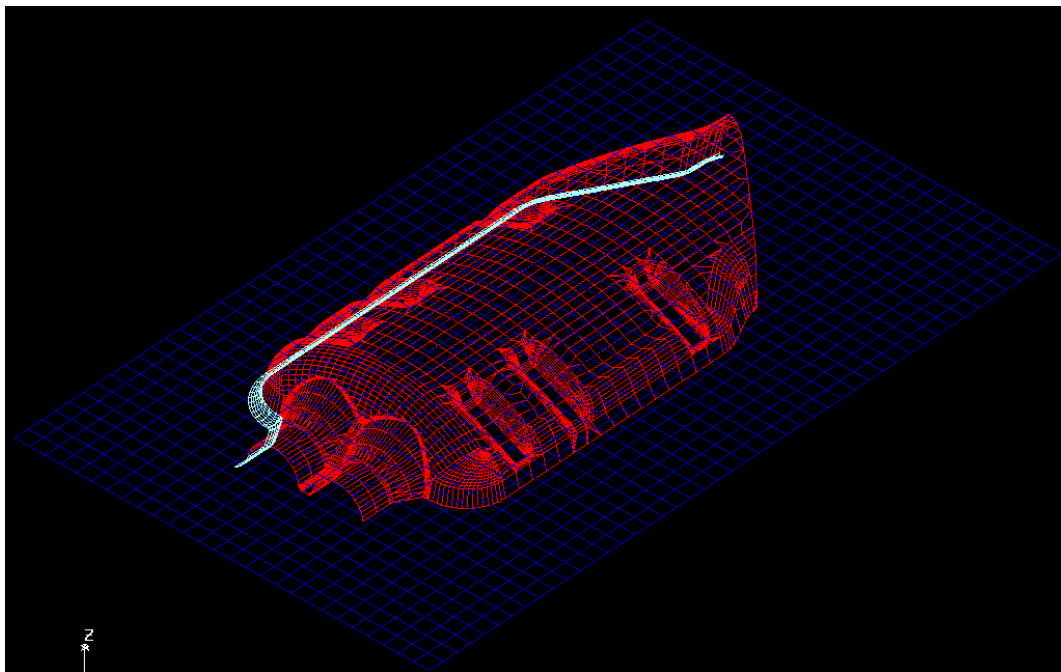
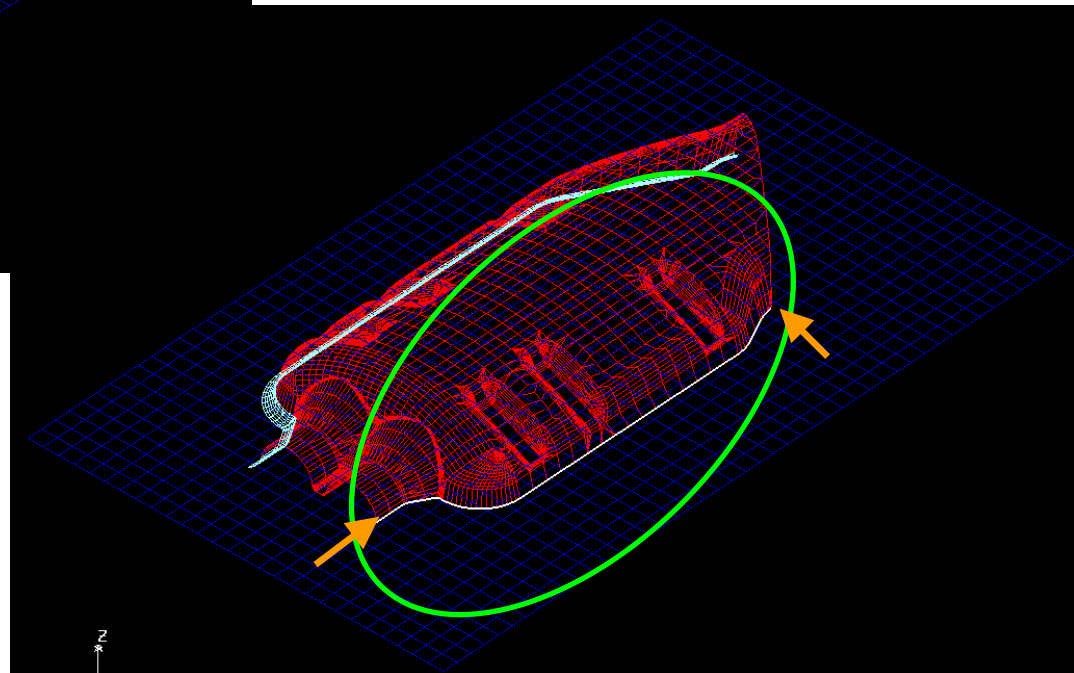


Figure 3.13

Tutorial III



(a)





(b)

Figure 3.14

Tutorial III

Insert addendum continue ...

- 27) Click on  to zoom in the region as shown in Figure 3.16a
- 28) Select **Master 1** from the Master Profile list (see Figure 3.15)
- 29) Click **Insert** (Addendum)
- 30) Click **Select Region**
- 31) Pick two nodes on die boundary to define segment as shown in Figure 3.16b
- 32) Click **Yes** to accept marked region
- 33) Click **Apply** to insert addendum segment
- 34) Click on  to display top view (as shown in Figure 3.17a)
- 35) Click **Select Region**
- 36) Pick two nodes on die boundary to define segment as shown in Figure 3.17b
- 37) Click **Yes** to accept marked region
- 38) Click **Apply** to insert addendum segment
- 39) Click **Close** to dismiss

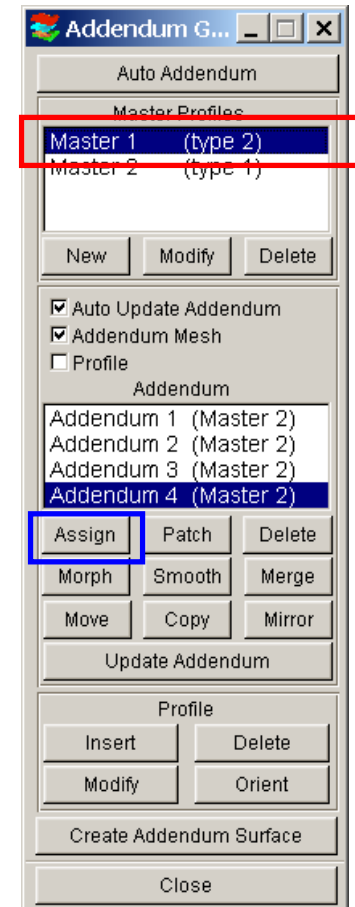
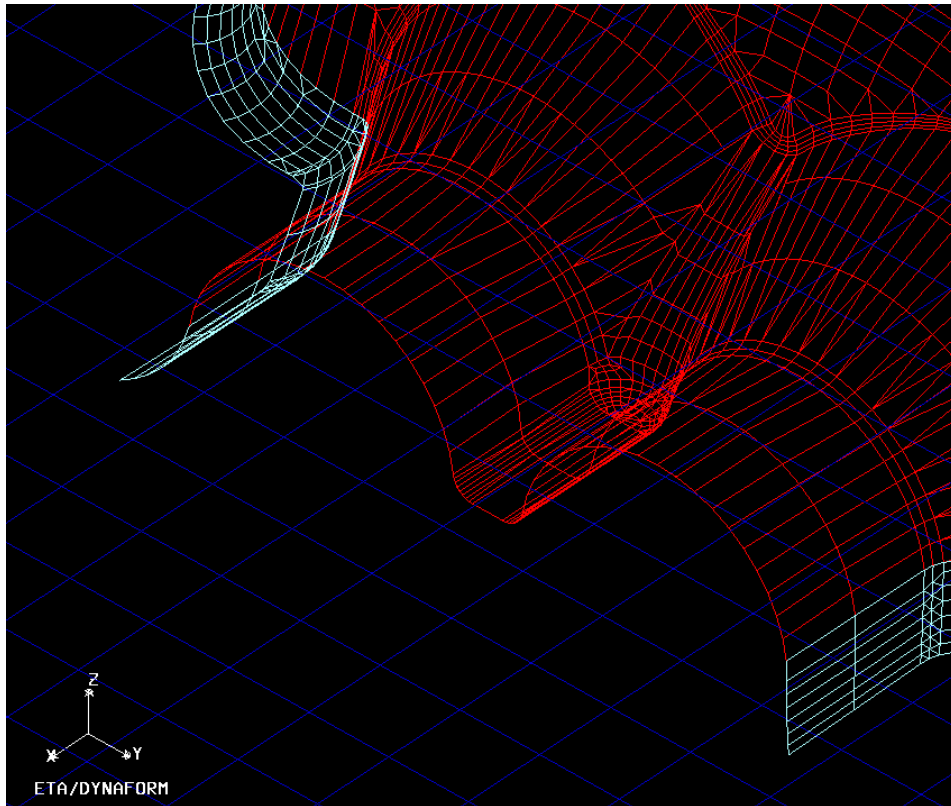
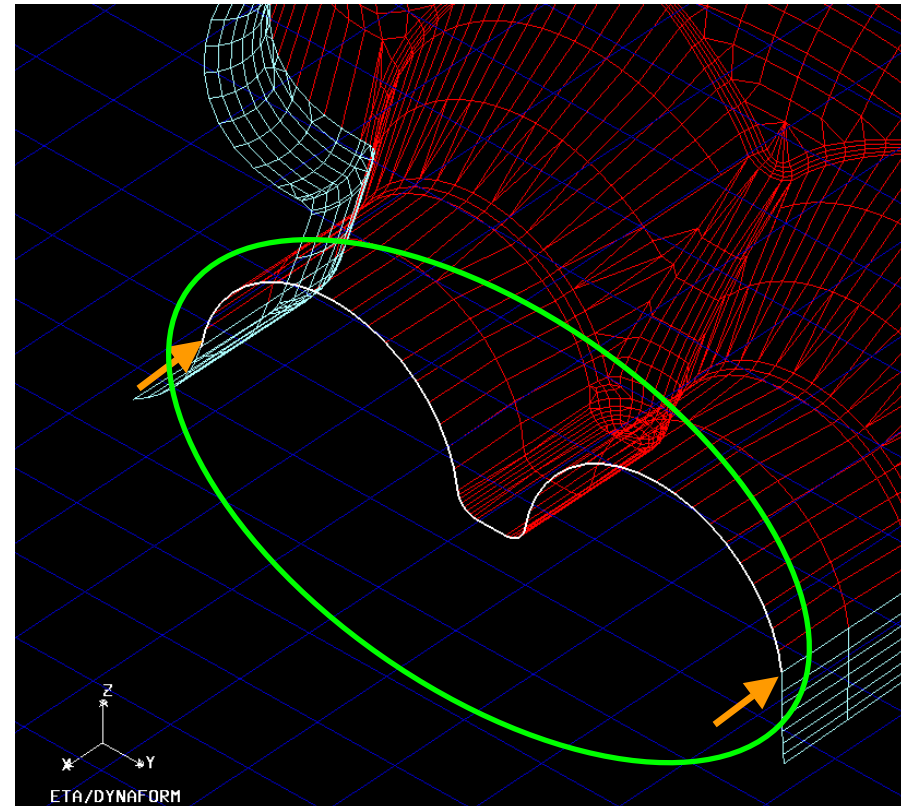


Figure 3.15

Tutorial III



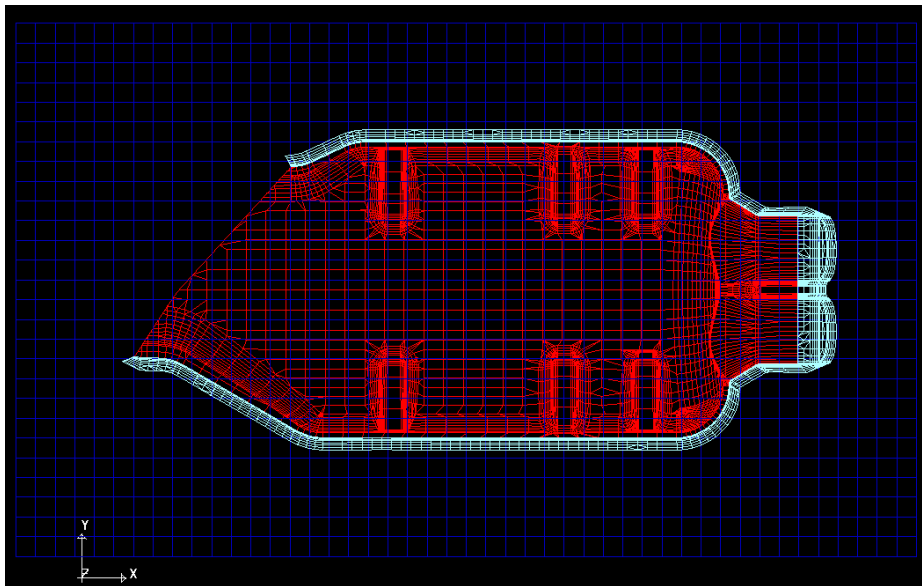
(a)



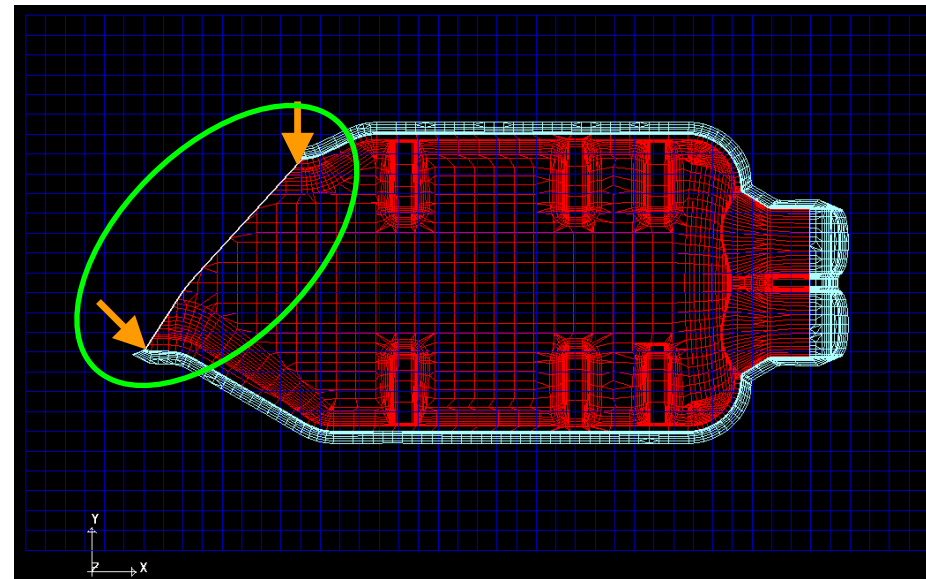
(b)

Figure 3.16

Tutorial III



(a)



(b)

Figure 3.17

Tutorial III

Insert addendum continue ...

40) Toggle on “**Shade**” from the display option
(See Figure 3.18)

41) Click on  to rotate the model

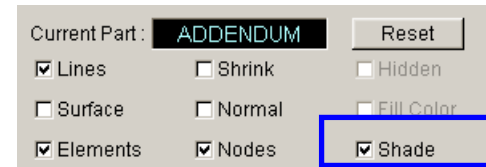



Figure 3.18

xi. Create addendum surface

- a) Click **Create Addendum Surface**
- b) Click **Close** to dismiss Addendum Generation dialog window
- c) Click on  to save the database
- d) See Figure 3.19
- e) Toggle off “**Shade**”
- f) Toggle on “**Surface**”

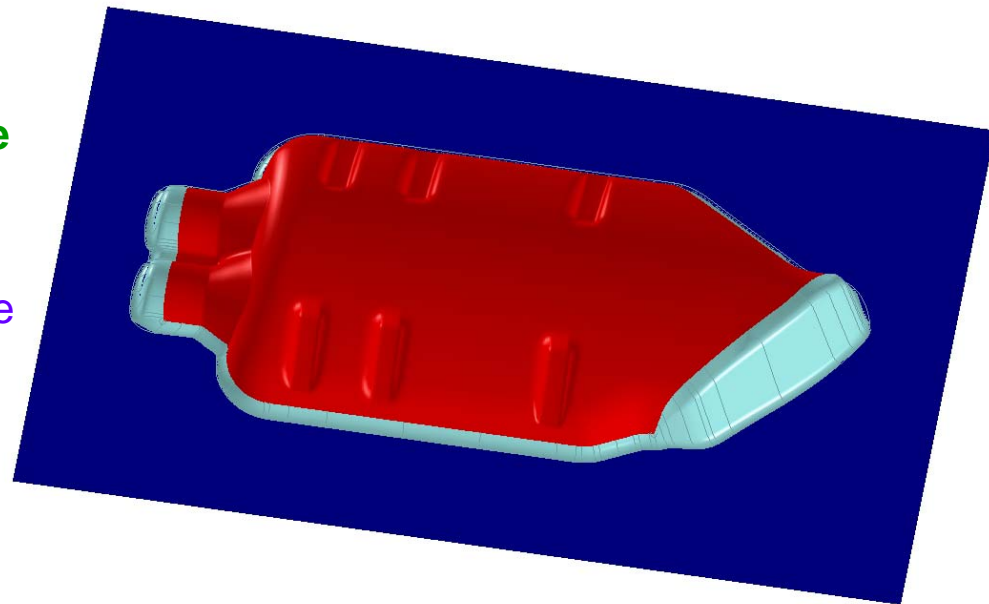



Figure 3.19

xiii. Binder trimming

- a) Click *DFE*
- b) Select *Modification*
- c) Select **BINDER TRIM** (See Figure 2.19a)
- d) Toggle off “Surface”
- e) Click **Select** to select trimline as shown in Figure 3.21a
- f) Click **Ok** to confirm the selection
- g) Click **Apply**
- h) Click **Yes** to accept the displayed line for binder trimming
- i) Click **Close** to dismiss Complete Binder dialog window
- j) Click **Exit** to dismiss Modification dialog window
- k) Click on  to save the database
- l) Turn off all parts and turn on **C_BINDER** (See Figure 3.21b)

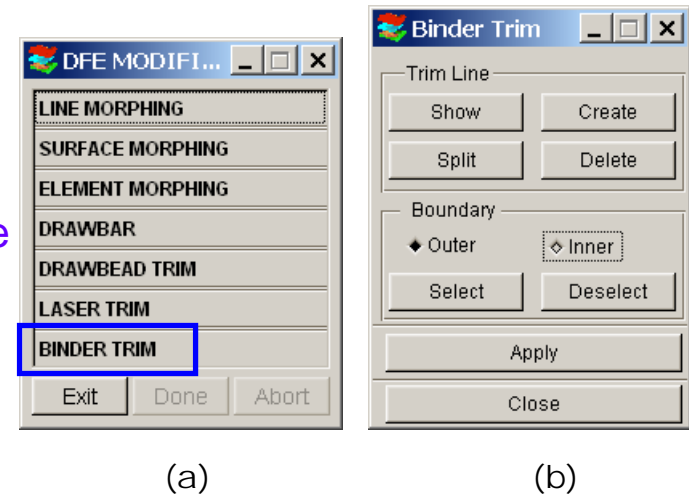


Figure 3.20

Tutorial III

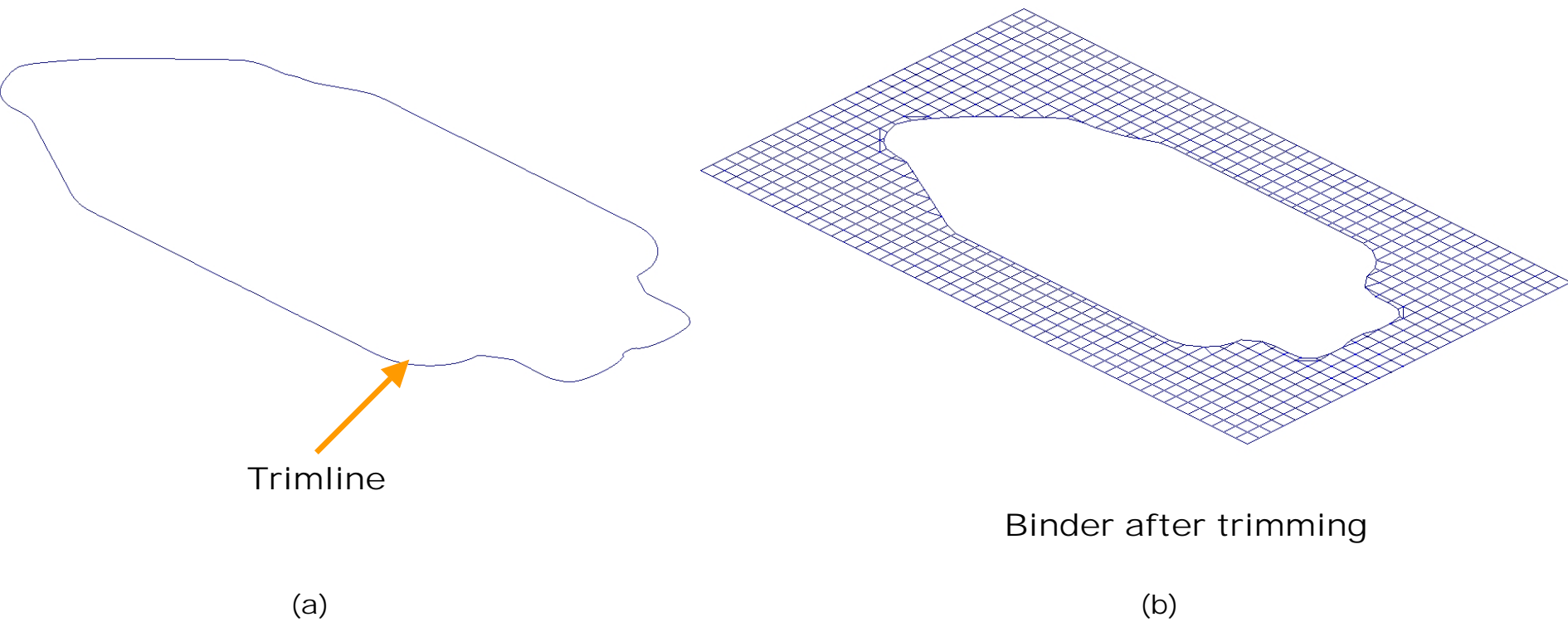


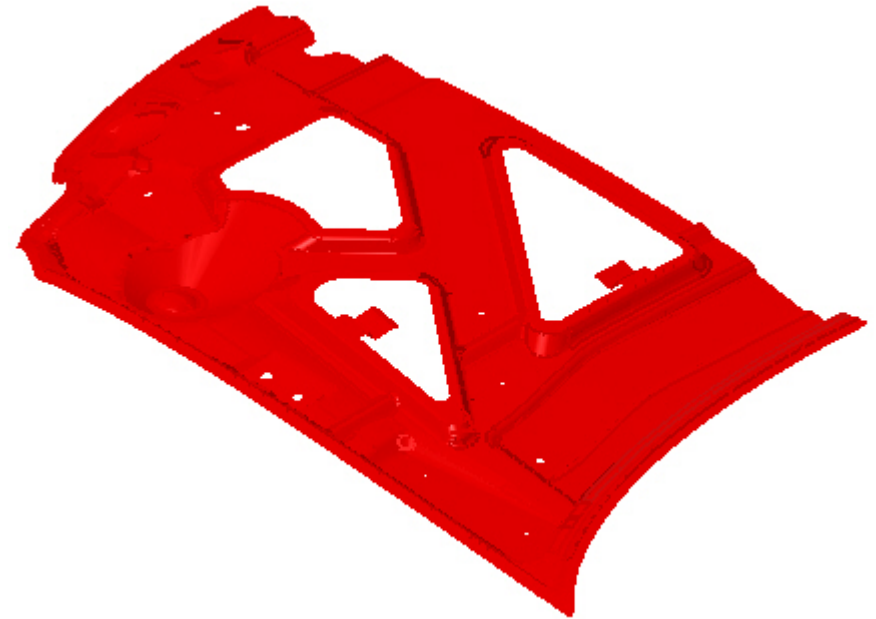
Figure 3.21

Tutorial IV

Hood inner to show Inner Fill, Symmetry, Outer Smooth, Flat Binder, Morphing etc.

Hood Inner DFE procedures :

- i. Open and save database
- ii. Importing part geometry
- iii. Rename Part
- iv. Auto-Meshing the surfaces
- v. Check and repair meshes
- vi. Tipping
- vii. Symmetry definition
- viii. Inner Fill
- ix. Outer Smooth
- x. Create Flat Binder
- xi. Create master profile
- xii. Insert addendum
- xiii. Smooth addendum




Hood Inner

Hood Inner DFE procedures continue ...

- xiv. Create addendum surface
- xv. Binder trimming
- xvi. Unfold flange and create trimline

Tutorial IV

i. Open and save database

- a) Click on  to create a new database
- b) Click **No** to deny saving the database (See Figure 4.1)
- c) Click on *File* and select *Save As ...*
- c) Type in “hoodinner_(user name)_(date).df” as File Name
- d) Click on **Save**

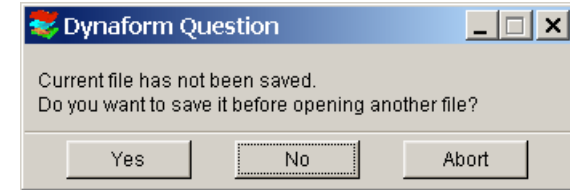


Figure 4.1

ii. Import part geometry

- a) Click on *DFE* (See Figure 4.2)
- b) Select *Preparation*
- c) Toggle on “**Surface**”
- d) Click **IMPORT**
- e) Select File location: .../Tutorial4_HoodInner
- e) Pick File name: hood_inner.igs
- f) Click **Ok** to import the part geometry

Tutorial IV

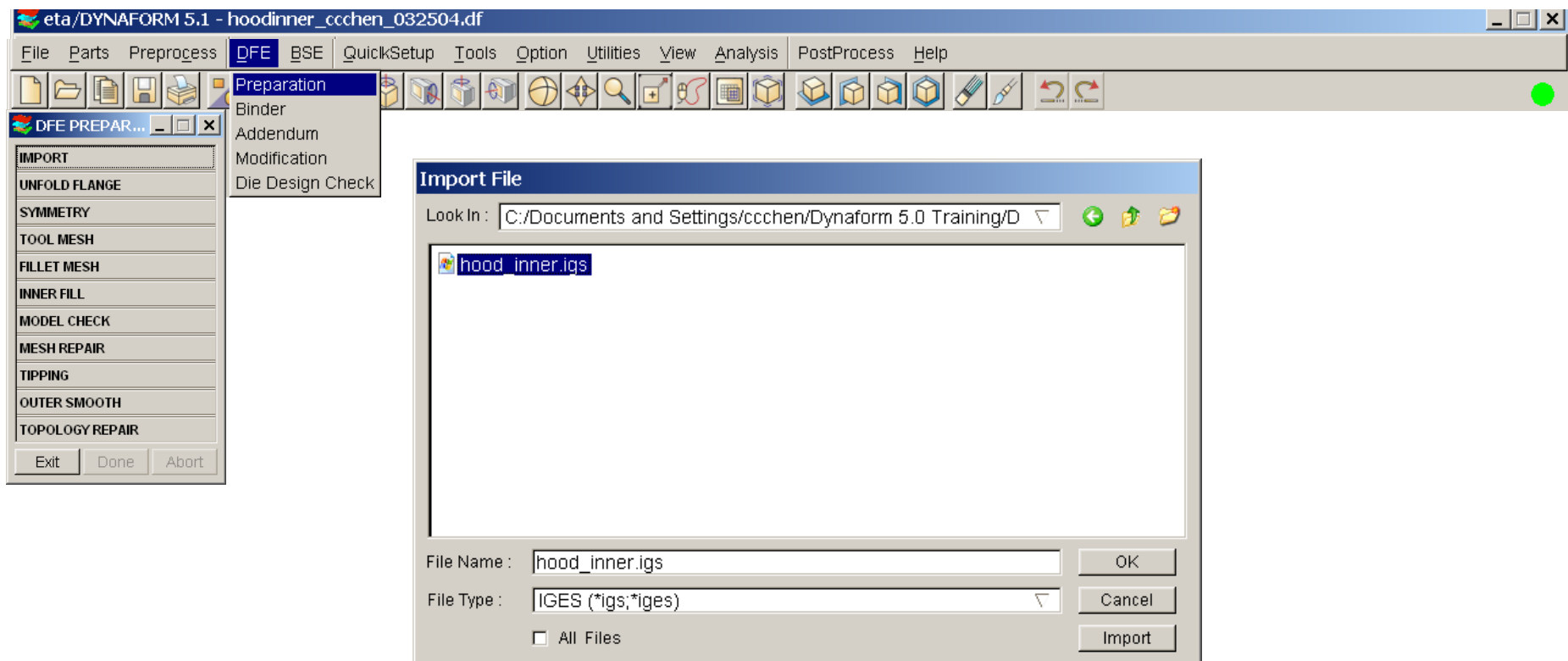


Figure 4.2

Tutorial IV

iii. Rename Part

- Click on **Parts** (See Figure 4.3)
- Select **Edit**
- Double click on the input box for Name to highlight Part C001V000 (See Figure 4.3)
- Type in “HOODINN”
- Click **Modify**
- Click **OK** to dismiss Edit Part dialog window

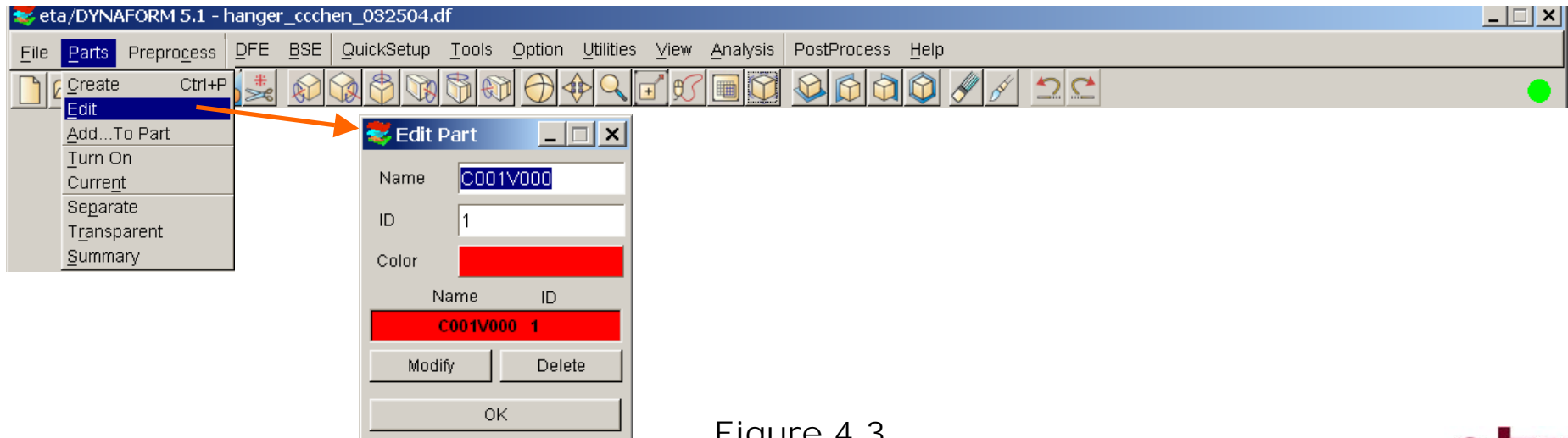



Figure 4.3

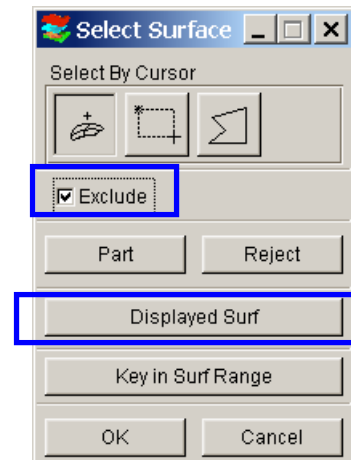
Tutorial IV

iv. Auto-Meshing the surfaces

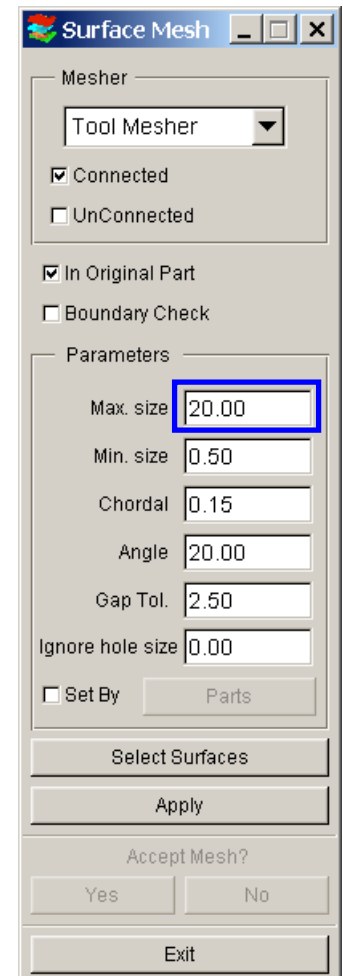
- a) Select **TOOL MESH** (See Figure 4.4a)
- b) Click **Displayed Surf.** to highlight all surfaces
- c) Toggle on “**Exclude**” (See Figure 4.4b)
- d) Select flange surfaces (See Figure 4.5a)
- e) Click **OK** to accept surfaces
- f) Select **Tool Mesher** (See Figure 4.4c)
- g) Key in Max. Size, **20.00** (mm)
- h) Click on **Apply**
- i) Click **Yes** to accept mesh
- j) Click **Exit** to dismiss Surface Mesh dialog window
- k) See Figure 4.5b
- l) Click on  to save the database



(a)



(b)



(c)

Figure 4.4

Tutorial IV

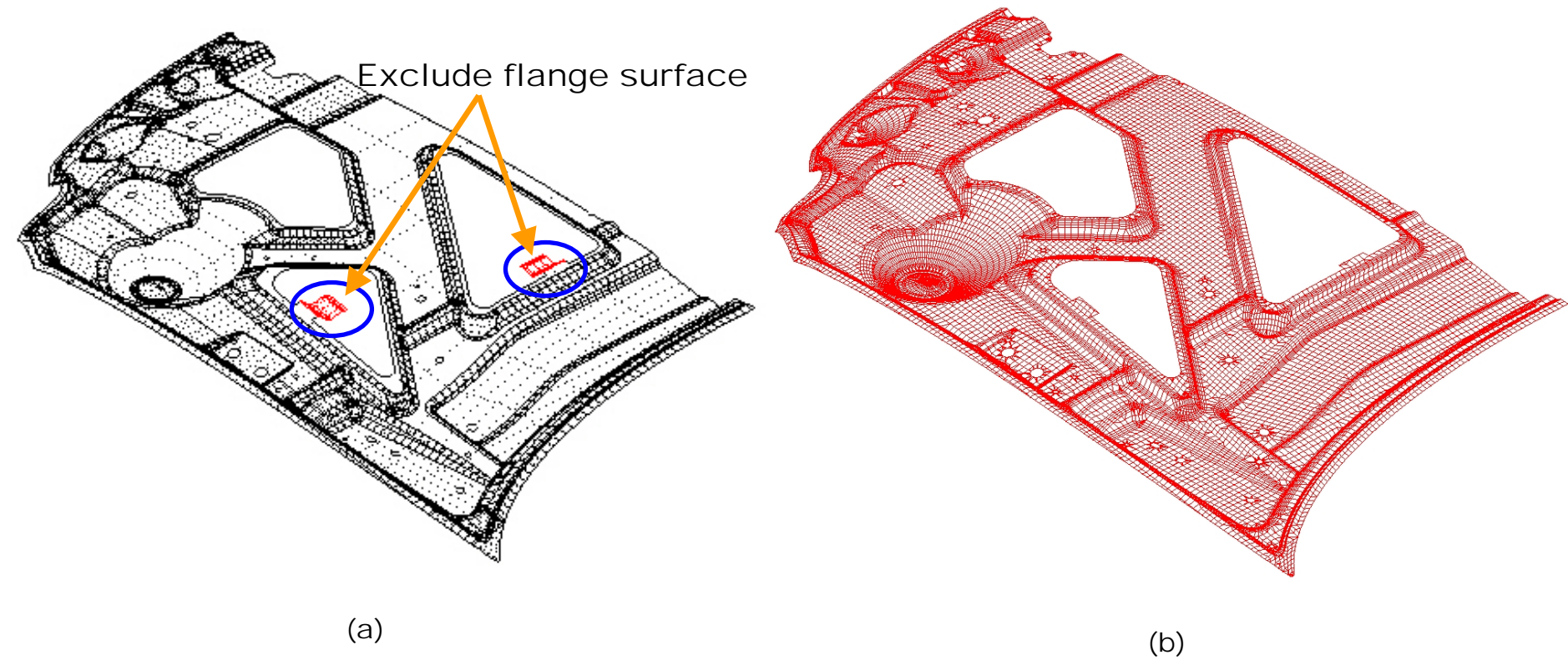



Figure 4.5

Tutorial IV

v. Check and repair meshes

- Select **MODEL CHECK**
- Click **Boundary Display** icon (Icon R1C2)
- Click on  (Clear highlight) to refresh screen
- Click **Plate Normal** icon (Icon R2C2)
- Read message window to make sure all normal is consistent
- Click **OK** to dismiss Model Check dialog window

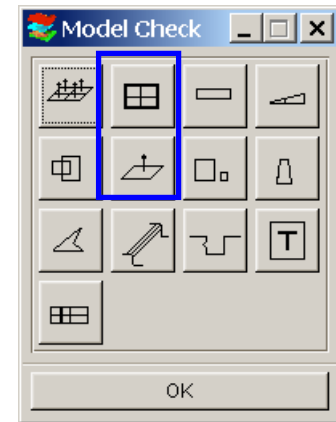


Figure 4.6

vi. Tipping

- Select **TIPPING** (Figure 4.7)
- Click **Yes** to assign the current part as Die (Figure 4.8)
- Toggle on "Undercut" (Figure 4.9)
- See Figure 4.10
- Click **Exit** to dismiss Tipping dialog window

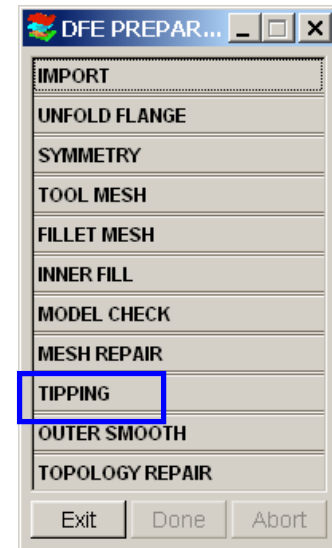


Figure 4.7

Tutorial IV

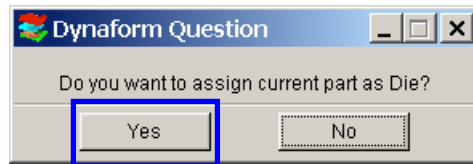


Figure 4.8

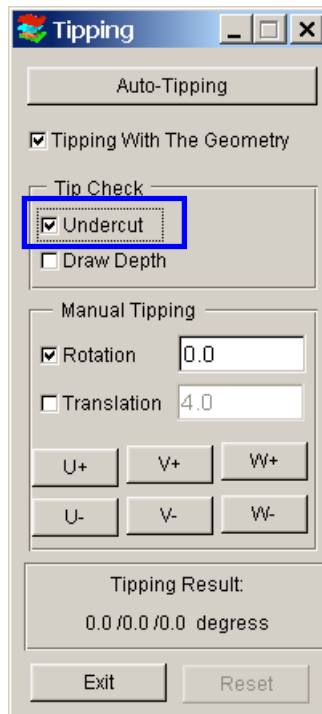
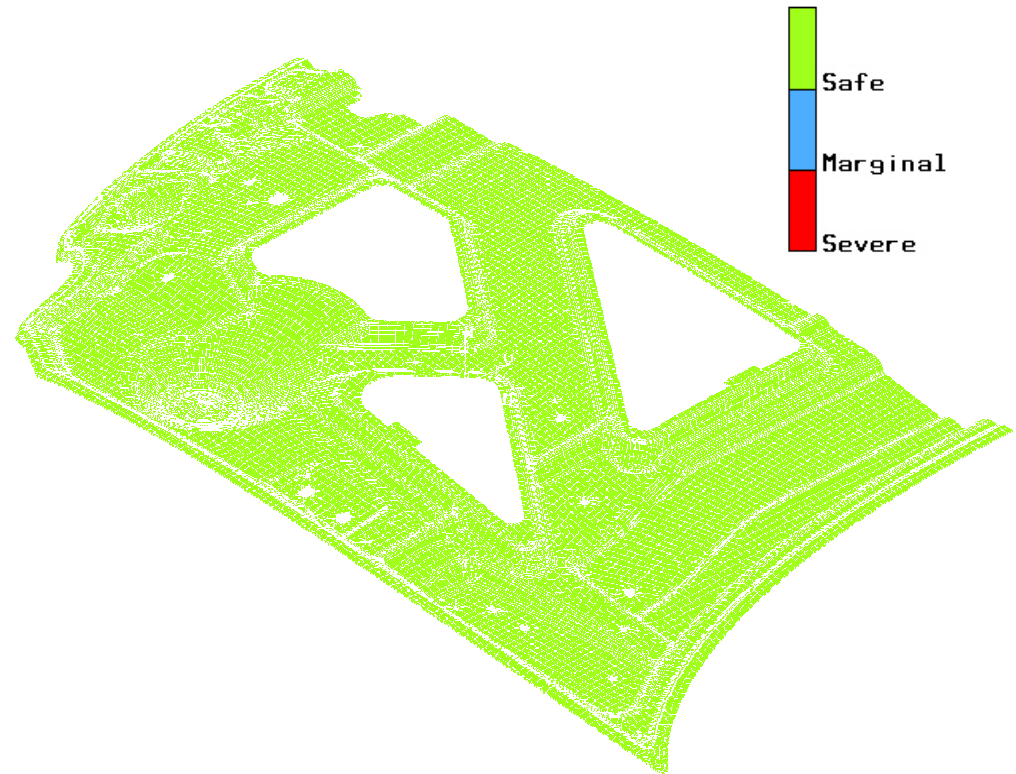


Figure 4.9




Tipping result

Figure 4.10

Tutorial IV

vii. Symmetry definition

- Select **SYMMETRY** (Figure 4.11a)
- Select Geometry Type, **Half Symmetry Input** (Figure 4.11b)
- Toggle on “two-xy-point” as symmetry type
- Click **Select Node(s)** to define symmetry plane
- Select two nodes as shown in Figure 4.12
- Click **Geometry Symmetry**
- Select the part for mirroring
- Click **OK** in the select part dialog window to confirm selection
- Click **OK** to dismiss Symmetry dialog window
- Click **Exit** to dismiss DFE Preparation dialog window
- Click on  to save the database

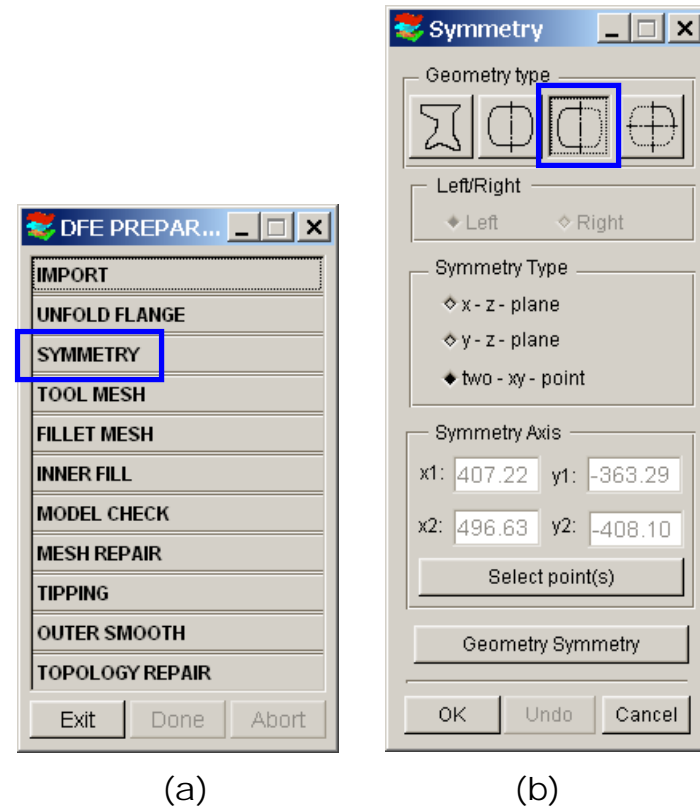


Figure 4.11

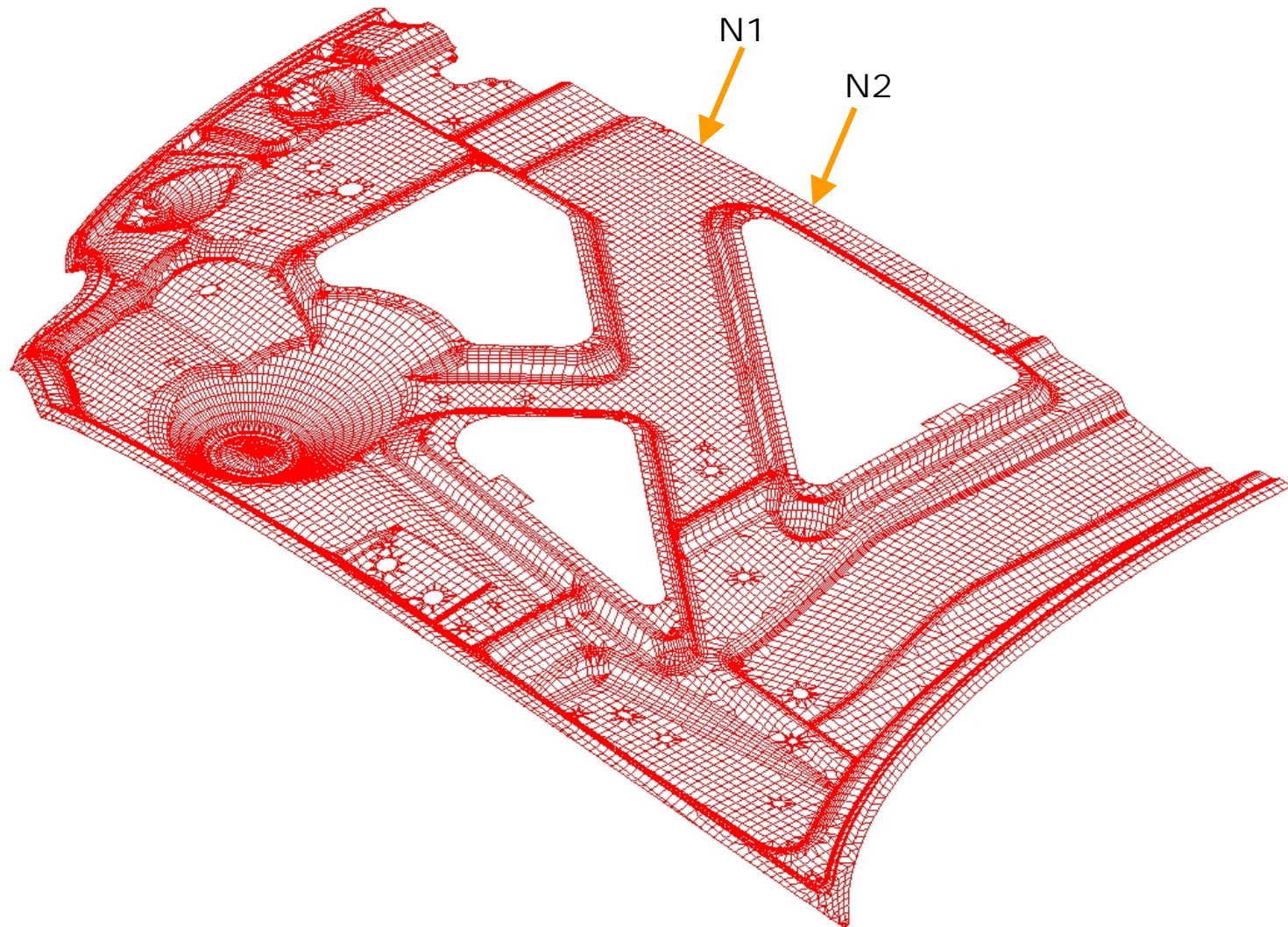



Figure 4.12

Tutorial IV

viii. Inner Fill

- a) Click *Parts*
- b) Select *Create*
- c) Type in Name, **INNFILL** (See Figure 4.13)
- d) Click **OK** to create new part
- e) Click *DFE*
- f) Select *Preparation*
- g) Select **INNER FILL** (Figure 4.14a)
- h) Click on **Auto Fill** icon (Figure 4.14b)
- i) Click **Exit** to dismiss Inner Boundary Fill dialog window³
- j) Click on  to display top view
- k) See Figure 4.15

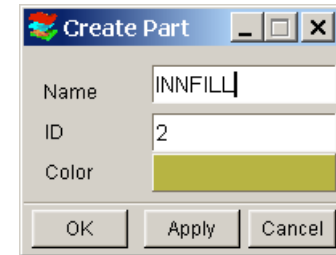
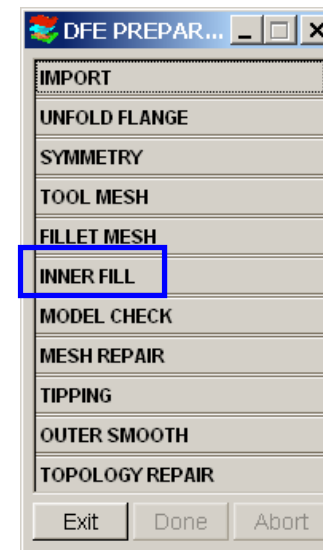
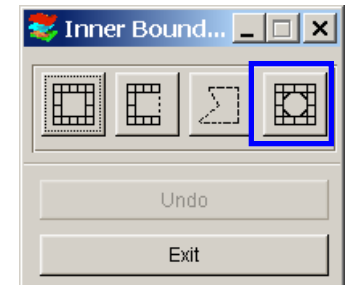


Figure 4.13

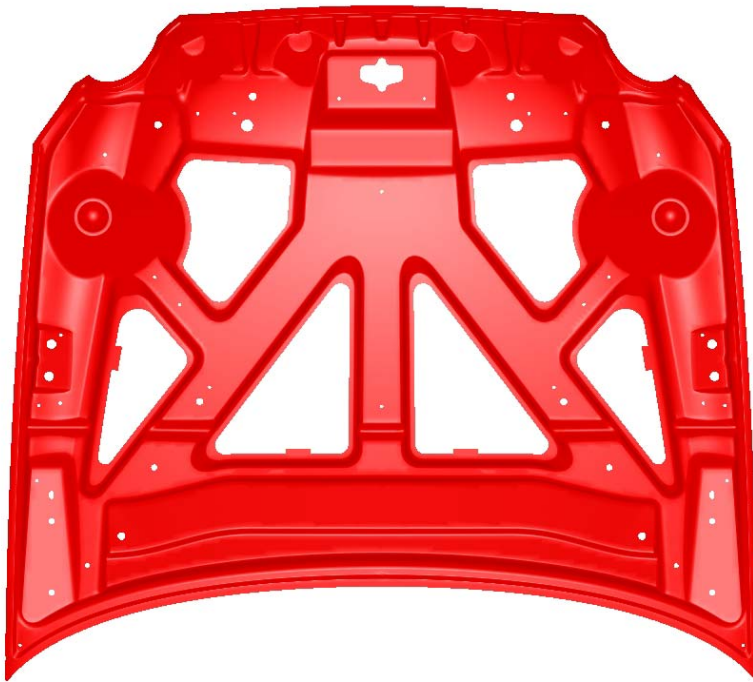


(a)

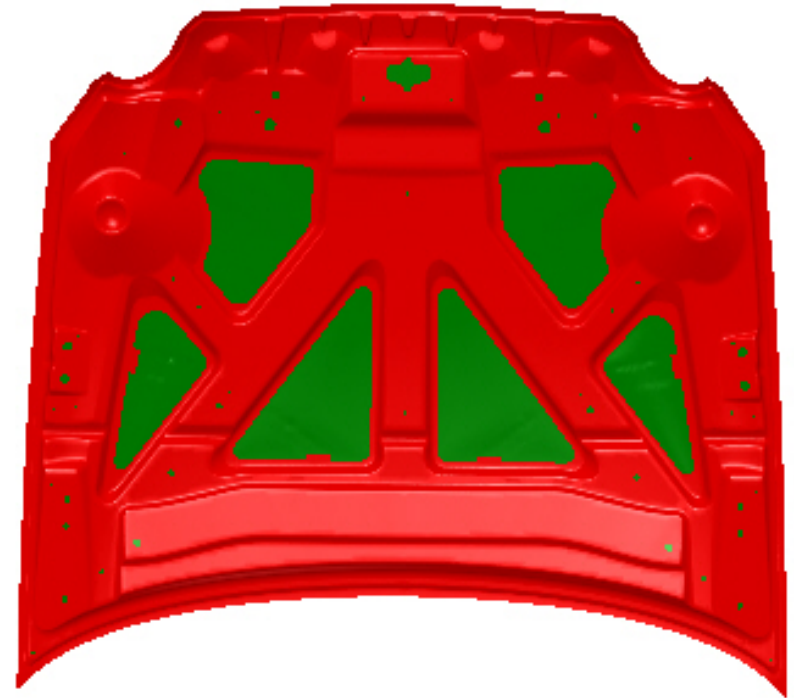


(b)

Figure 4.14



Before INNER FILL



After INNER FILL

Figure 4.15

ix. Outer Smooth

- a) Select **OUTER SMOOTH**
- b) Select **Roller** (Figure 4.16)
- c) Key in Roll Radius, **300.00** (mm)
- d) Click **Create Boundary**
- e) Click **Fill Boundary**
- f) Click **Exit**
- g) Repeat step (iv) to check and repair the mesh
- h) See Figure 4.17

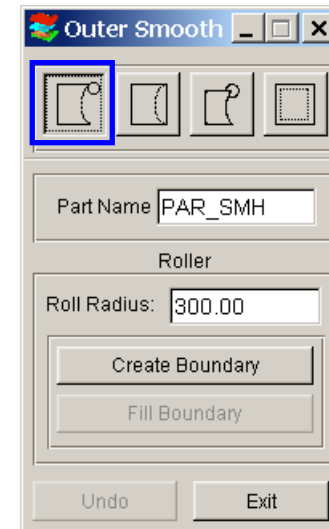


Figure 4.16

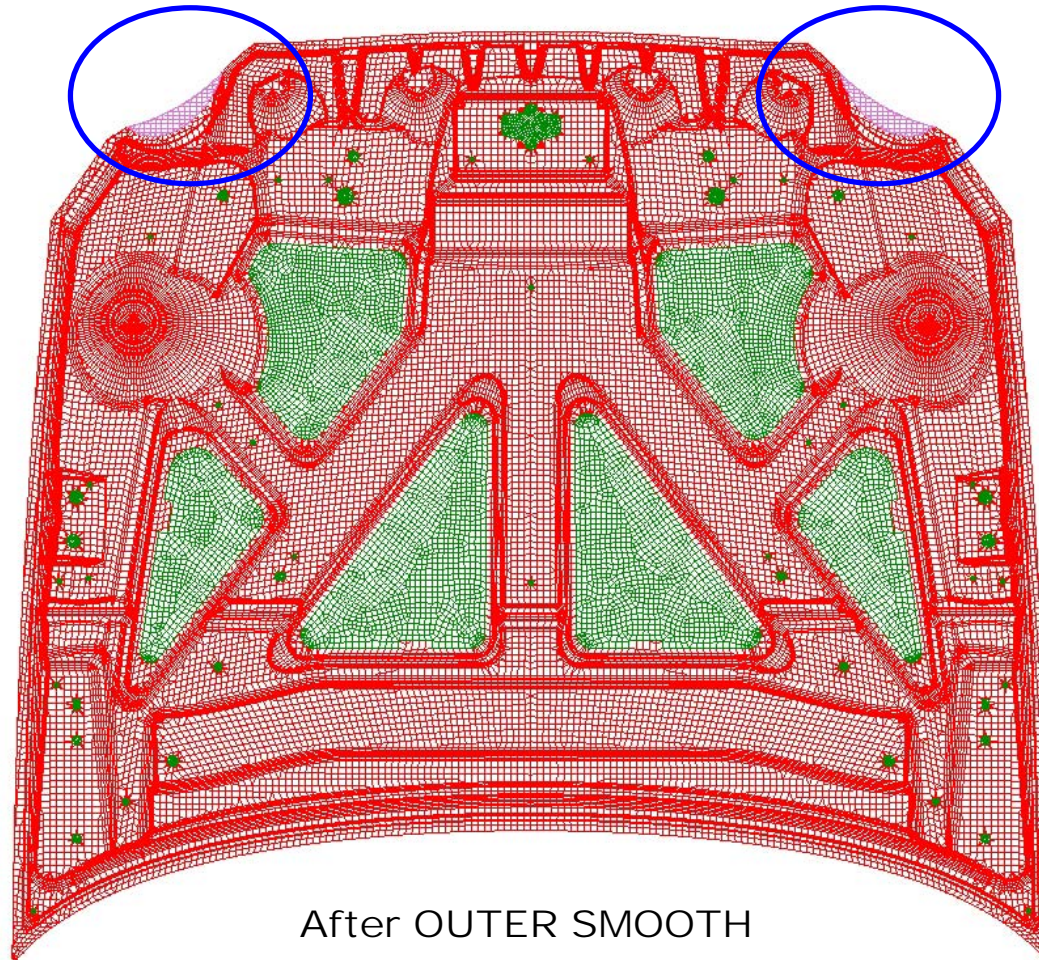

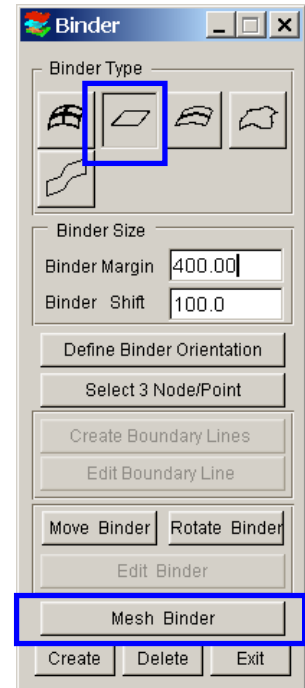


Figure 4.17

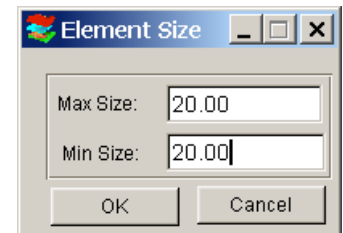
Tutorial IV

x. Create Flat Binder

- a) Click *DFE*
- b) Select *Binder*
- c) Select Binder Type, **Flat Binder** (Figure 4.18a)
- d) Key in Binder Margin, **400.00** (mm)
- e) Click **Define Binder Orientation**
- f) Click **MMB**
- g) Click **Create**
- h) Click **Mesh Binder**
- i) Key in Max and Min Element Size, **20.00** (mm) (Figure 4.18b)
- j) Click **OK**
- k) Click **Move Binder** (Figure 4.19a)
- l) Toggle on “W” as move direction (Figure 4.19b)
- m) Key in distance, **60.00** (mm)
- n) Click **Apply**
- o) Click **Ok** to dismiss UVW INCREMENT dialog window
- p) Click **Exit** to dismiss Binder dialog window
- q) Click on  to save the database



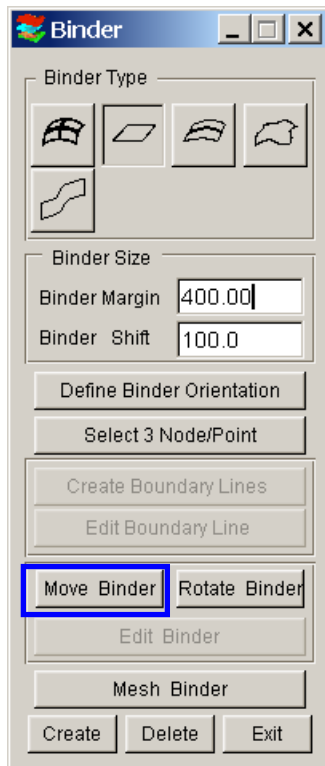
(a)



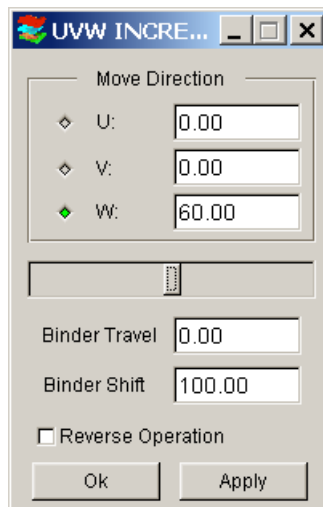
(b)

Figure 4.18

Tutorial IV

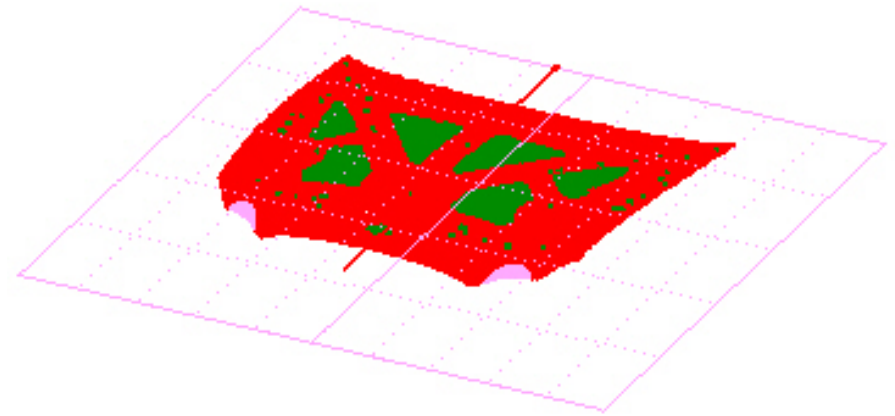


(a)

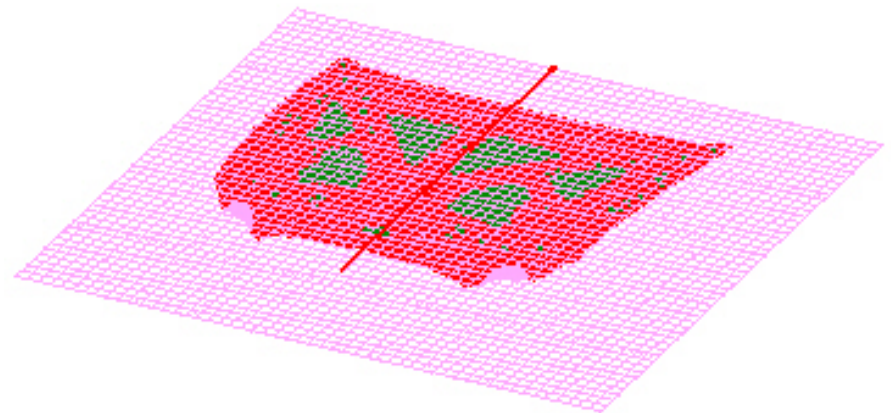


(b)

Figure 4.19



Create Flat Binder surface



Mesh Binder surface

Figure 4.20

xi. Create master profile

- a) Click on *DFE*
- b) Select *Addendum*
- c) Click **New** (Master Profiles) (See Figure 4.21)
- d) Select Profile Type **#3**, as shown in Figure 4.21
- e) Click **Ok** to dismiss Master Profile dialog window

Tutorial IV

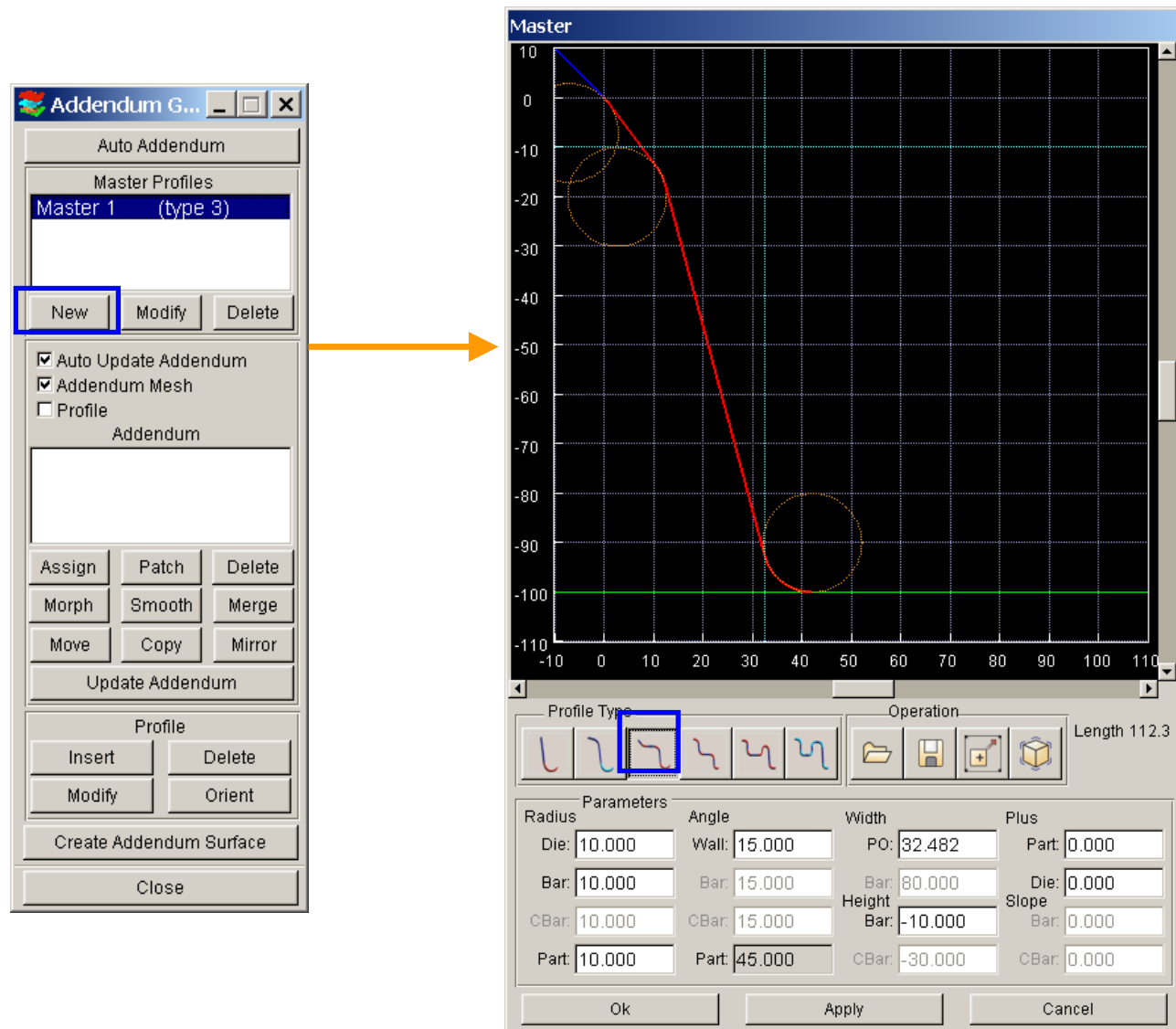



Figure 4.21

Tutorial IV

xii. Insert addendum

- Click **Assign** (Addendum) (See Figure 4.22)
- Select type “**Outer**”
- Toggle off “**By Segment**”
- Click **Apply** to generate the addendum, as shown in Figure 4.23
- Click **Close** to dismiss Insert Addendum dialog window
- Click on  to display isometric view

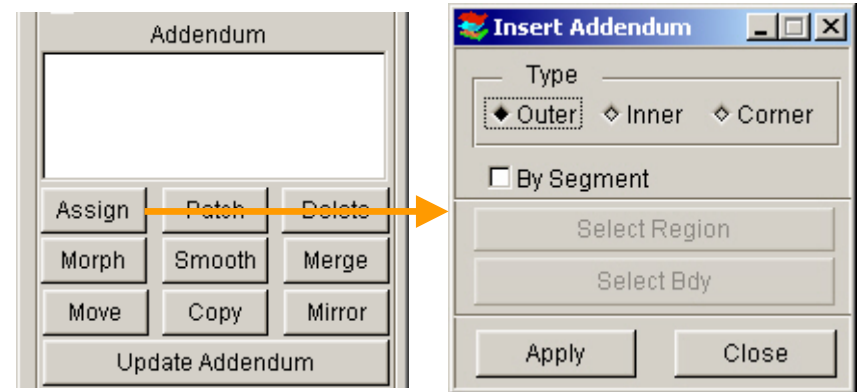


Figure 4.22

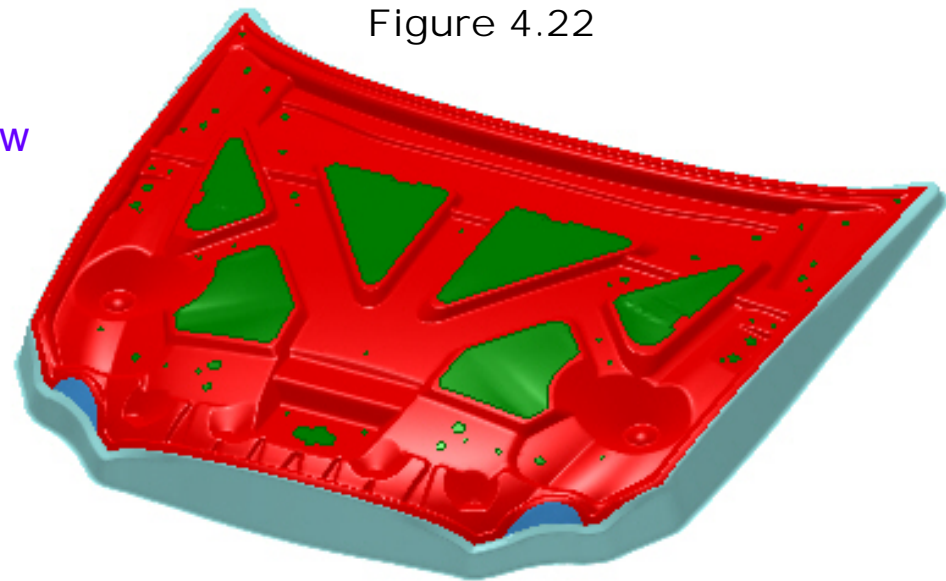


Figure 4.23

xiii. Smooth addendum

- a) Click **Smooth** (Figure 4.24a)
- b) Toggle on “POP line” (Figure 4.24b)
- c) Click **Apply**
- d) Toggle on “Through Point Smooth” (Figure 4.24c)
- e) Use the rotational and zooming icons to zoom out the region as shown in Figure 4.25
- f) Click **Select Fixed Points** (Select 4 points as shown in Figure 4.25)
- g) Click **Preview**
- h) Click **Apply**
- i) Click **OK**
- j) Repeat steps (b) to (h) to smooth another segment of POP line
- k) Click **Close** to dismiss Smooth Addendum dialog window

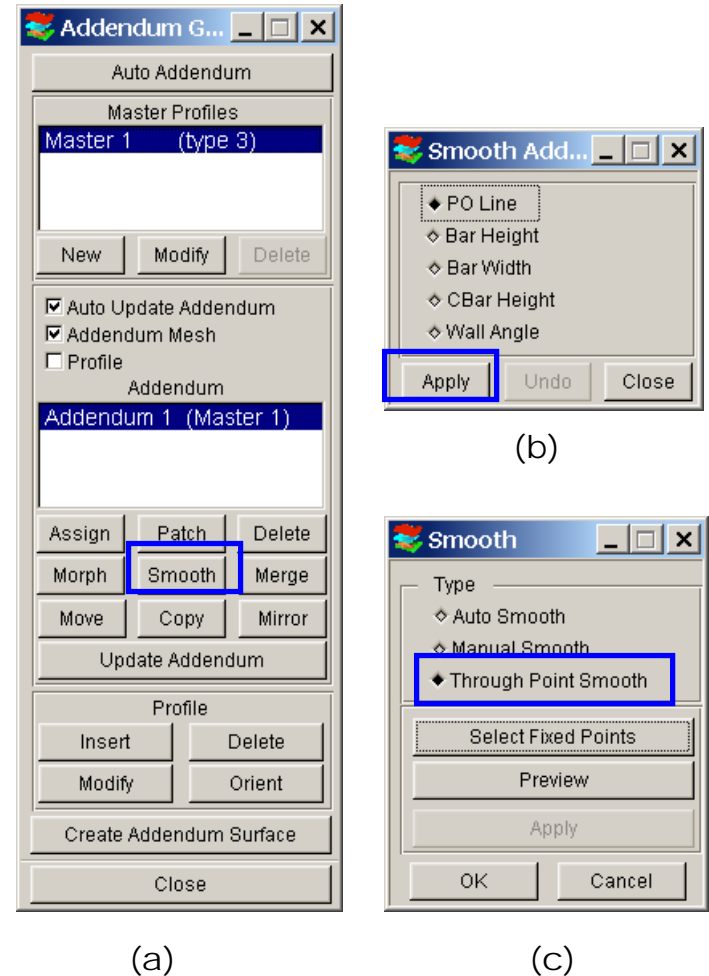


Figure 4.24

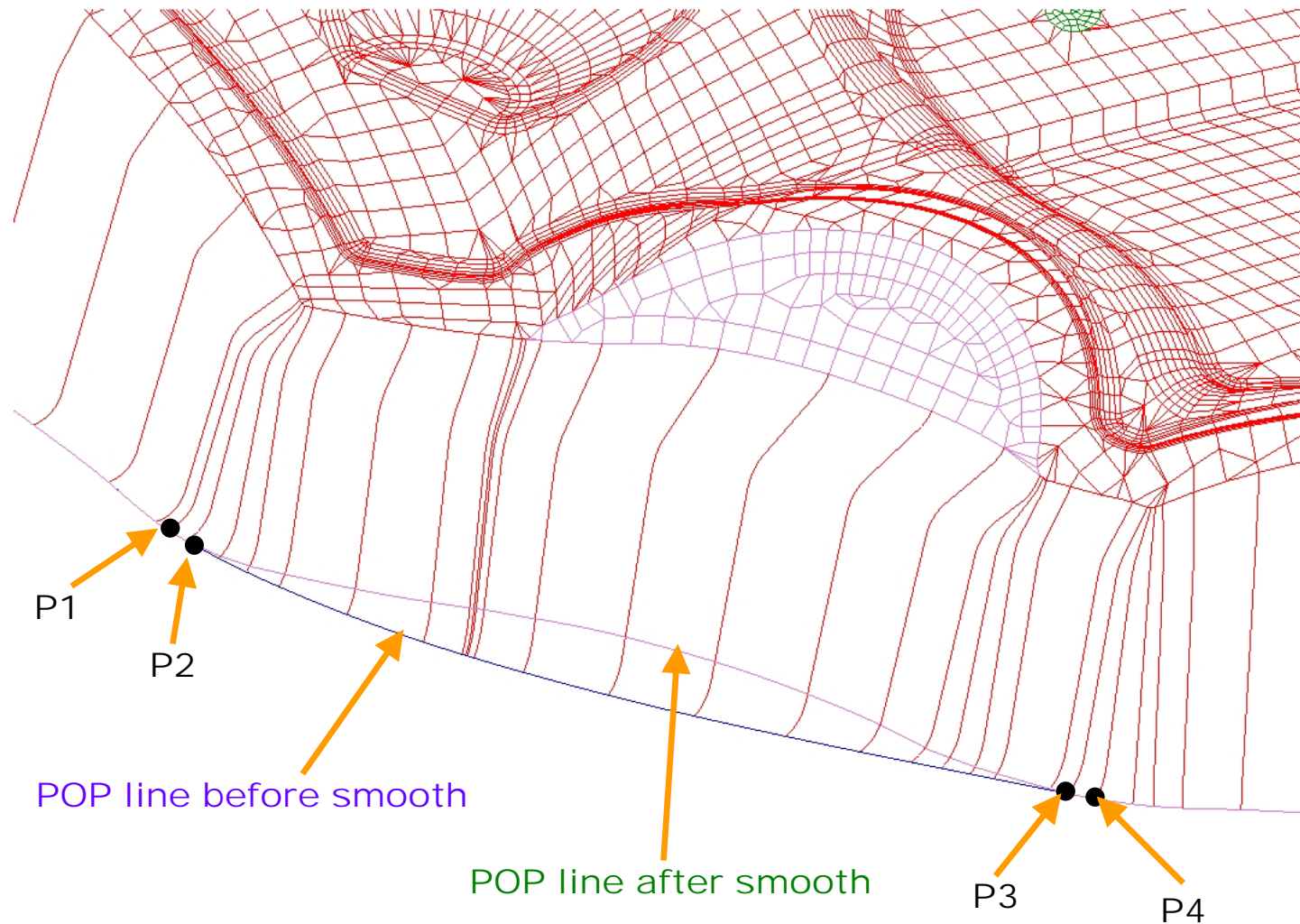


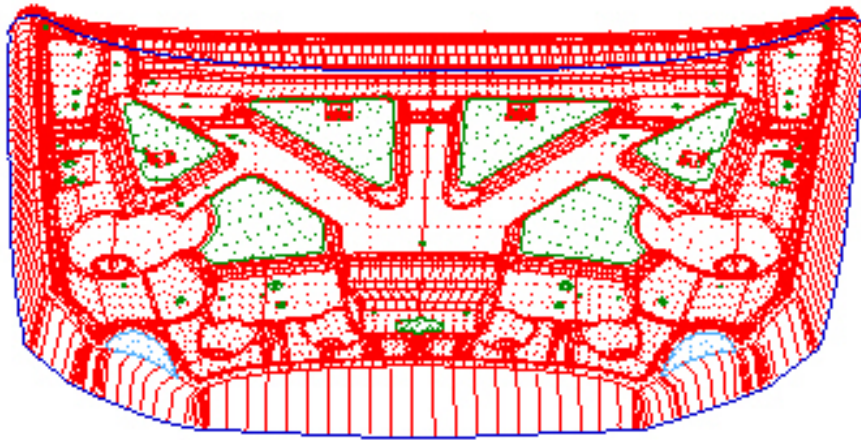


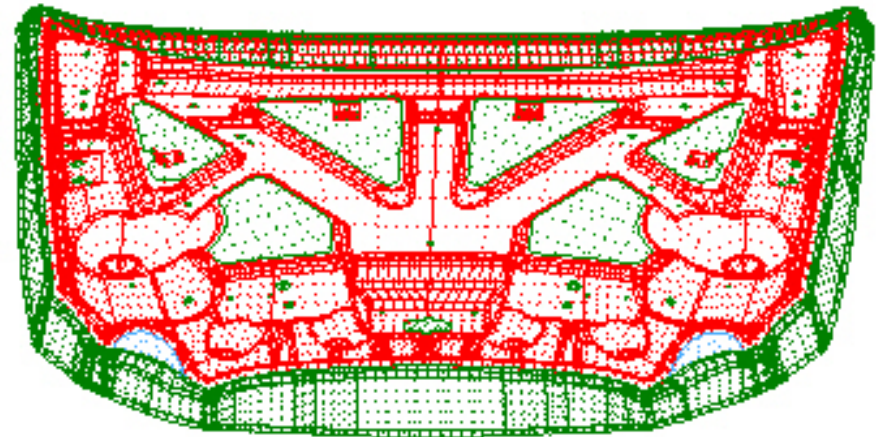
Figure 4.25

xiv. Create addendum surface

- a) Click **Create Addendum Surface**
- b) Click **Close** to dismiss Addendum Generation dialog window
- c) Click on  to display isometric view
- d) Click on  to save the database



Before Create Addendum Surface





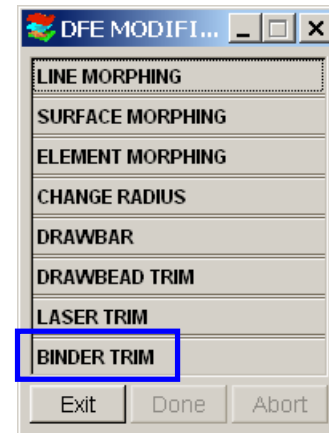
After Create Addendum Surface

Figure 4.26

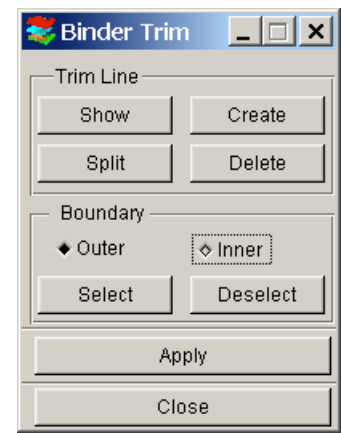
Tutorial IV

xv. Binder trimming

- a) Click *DFE*
- b) Select *Modification*
- c) Select **BINDER TRIM** (Figure 4.27a)
- d) Toggle off “Surface”
- e) Click **Select**
- f) Select trimline as shown in Figure 4.28a
- g) Click **Ok** to confirm the selection
- h) Click **Apply**
- i) Click **Yes** to accept the displayed line for binder trimming
- j) Click **Close** to dismiss Complete Binder dialog window
- k) Click on  to display top view
- l) Turn off all parts and turn on **C_BINDER** (Figure 4.28b)
- m) Click **Exit** to dismiss DFE MODIFICATION dialog window
- n) Toggle on “Surface”
- o) Click on  to save the database



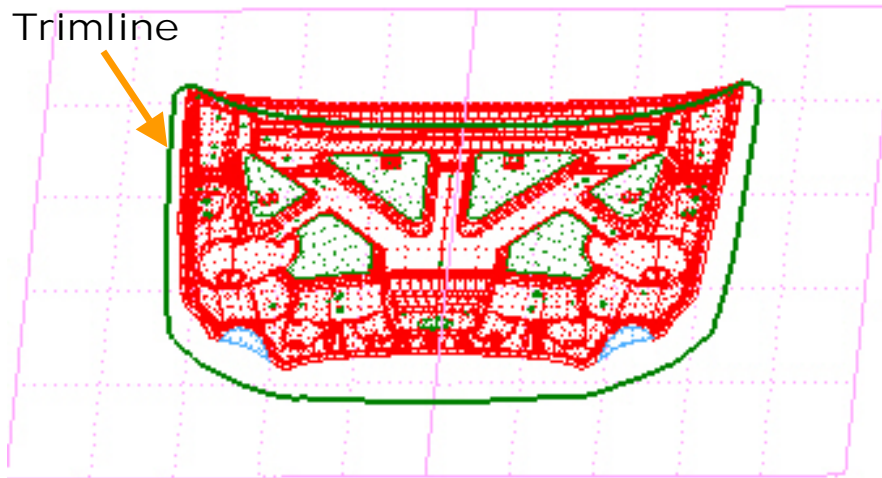
(a)



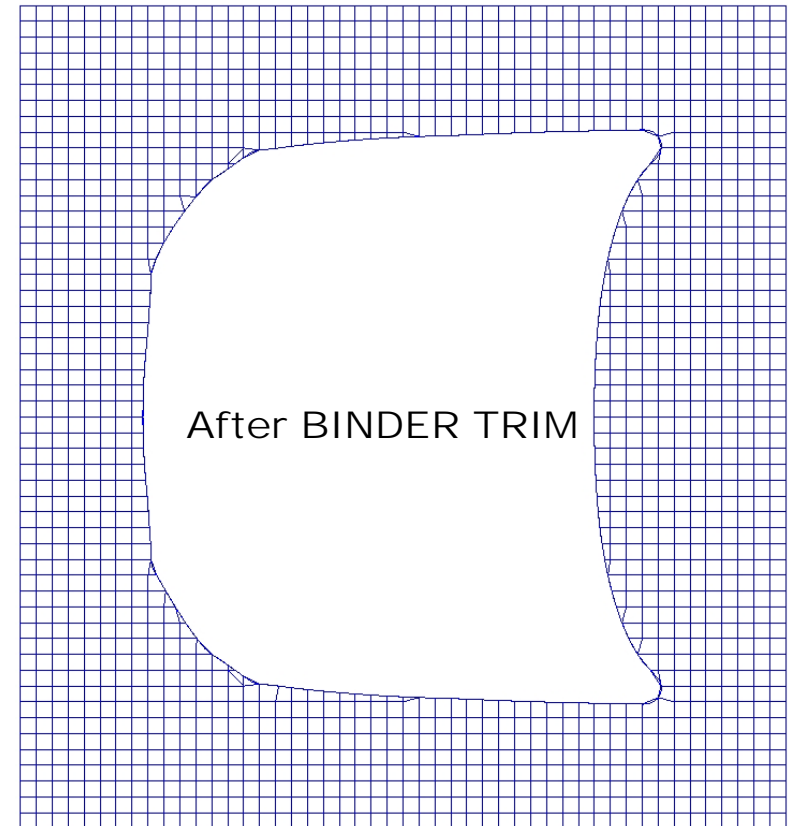
(b)

Figure 4.27

Tutorial IV



(a)




(b)

Figure 4.28

Tutorial IV

xvi. Unfold flange and create trimline

- a) Click **DFE**
- b) Select **Preparation**
- c) Select **UNFOLD FLANGE** (Figure 4.29a)
- d) Use rotational and zooming tools to zoom out the region as shown in Figure 4.31a
- e) Select flange surfaces as shown in Figure 4.31a
- f) Click **OK** to confirm selection
- g) Select **ACCEPT** to accept the baseline (Figure 4.30a)
- h) Click **OK** to accept bend angle, 0° (Figure 4.30b)
- i) Click **Done** to complete the unfolding operation (Figure 4.30c)
- j) Repeat steps (c) to (h) to unfold the remaining flanges
- k) Click **Exit** to dismiss DFE Preparation dialog window
- l) Boundary of unfolded surfaces will be used to generate trimline
- m) Click on  to save the database

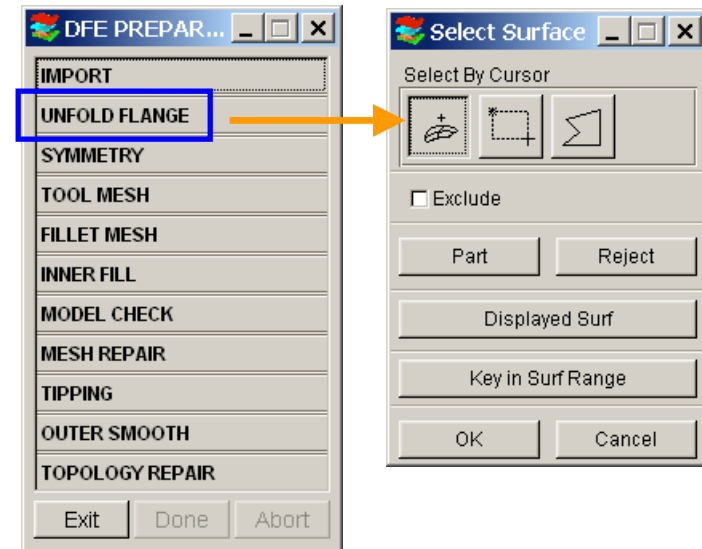


Figure 4.29

Tutorial IV

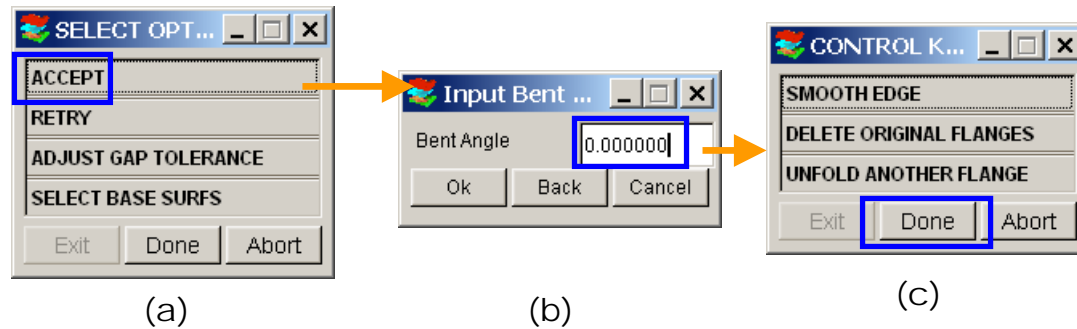


Figure 4.30

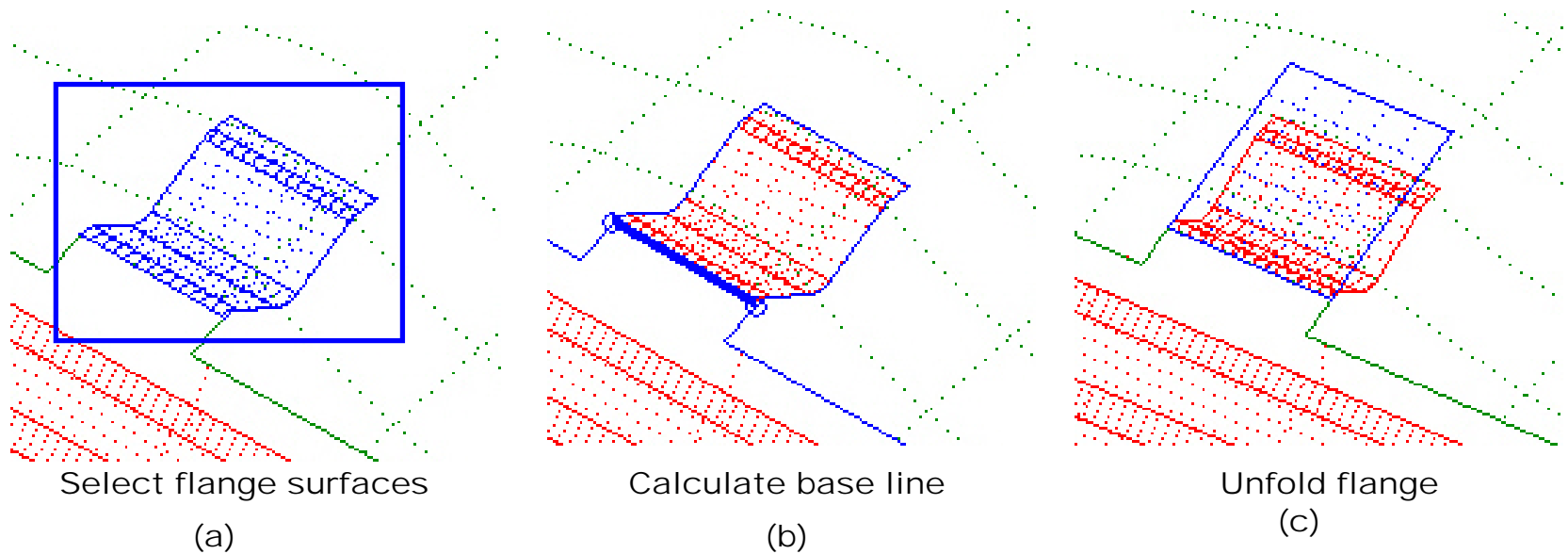


Figure 4.31

Tutorial V


*Door Outer to show Inner Fill, Inner Binder & Addendum,
Morphing, Outer Binder & Addendum*

Door Outer DFE procedures:

- i. Open and save database
- ii. Importing part geometry
- iii. Rename Part
- iv. Auto-Meshing the surfaces
- v. Check and repair meshes
- vi. Tipping
- vii. Inner Fill: Close Curve
- viii. Inner Fill: Open Curve
- ix. Create inner binder
- x. Create inner addendum
- xi. Inner binder trimming
- xii. Create outer binder
- xiii. Create outer addendum
- xiv. Adjust Profile Orientation
- xv. Morphing POP Line
- xvi. Outer Binder trimming

Tutorial V

i. Open and save database

- a) Click on  to create a new database
- b) Click **No** to deny saving the database (See Figure 5.1)
- c) Click on *File* and select *Save As ...*
- c) Type in “doorouter_(user name)_(date).df” as File Name
- d) Click on **Save**

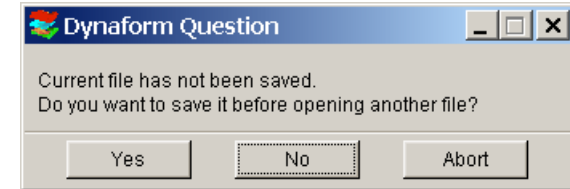


Figure 5.1

ii. Import part geometry

- a) Click on *DFE* (See Figure 5.2)
- b) Select *Preparation*
- c) Click **IMPORT**
- d) Click on drop down menu to change File Type, **CATIA4**
- e) Select File location: .../Tutorial4_DoorOuter
- e) Pick File name: door_outer.igs
- f) Click **Ok** to import the part geometry

Tutorial V

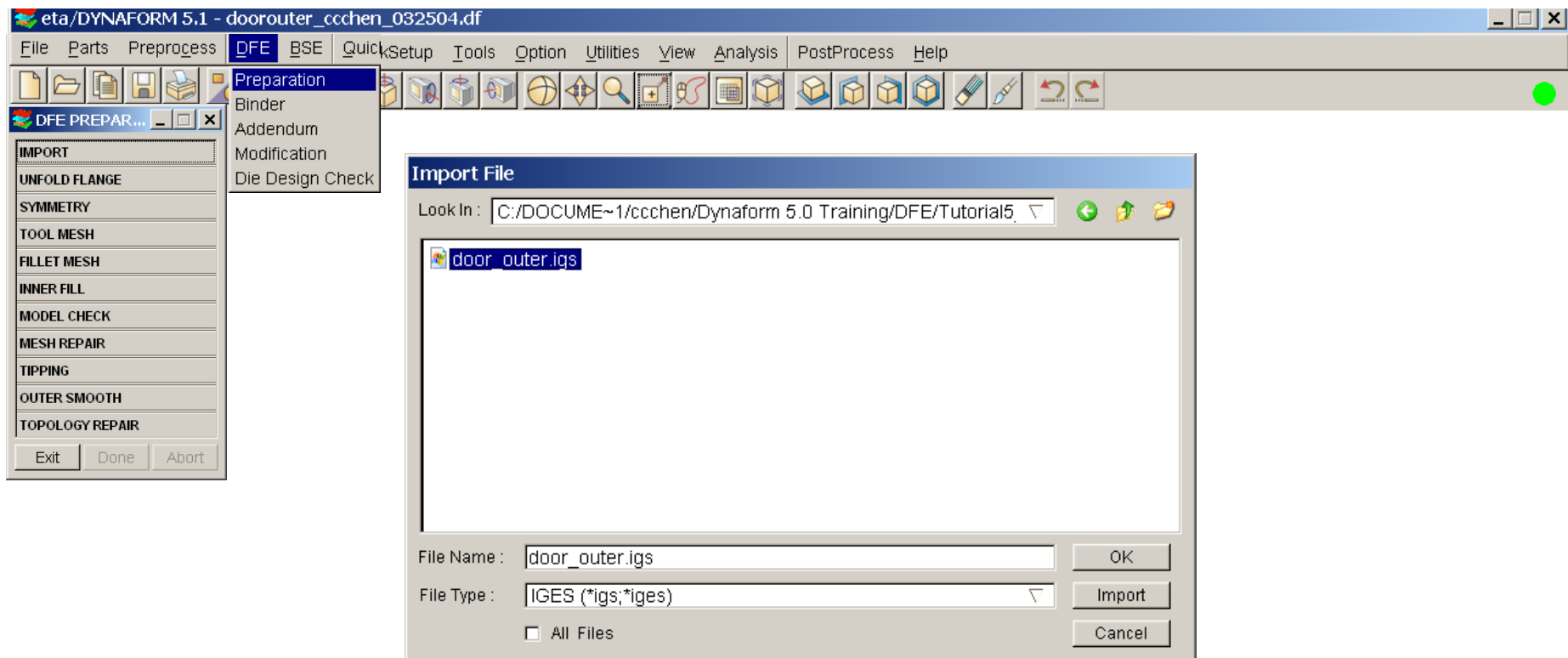


Figure 5.2

iii. Rename Part

- Click on **Parts** (See Figure 5.3)
- Select **Edit**
- Double click on the input box for Name to highlight Part C001V000 (as shown Figure 5.3)
- Type in “DOOROTR”
- Click **Modify**
- Click **OK** to dismiss Edit Part dialog window

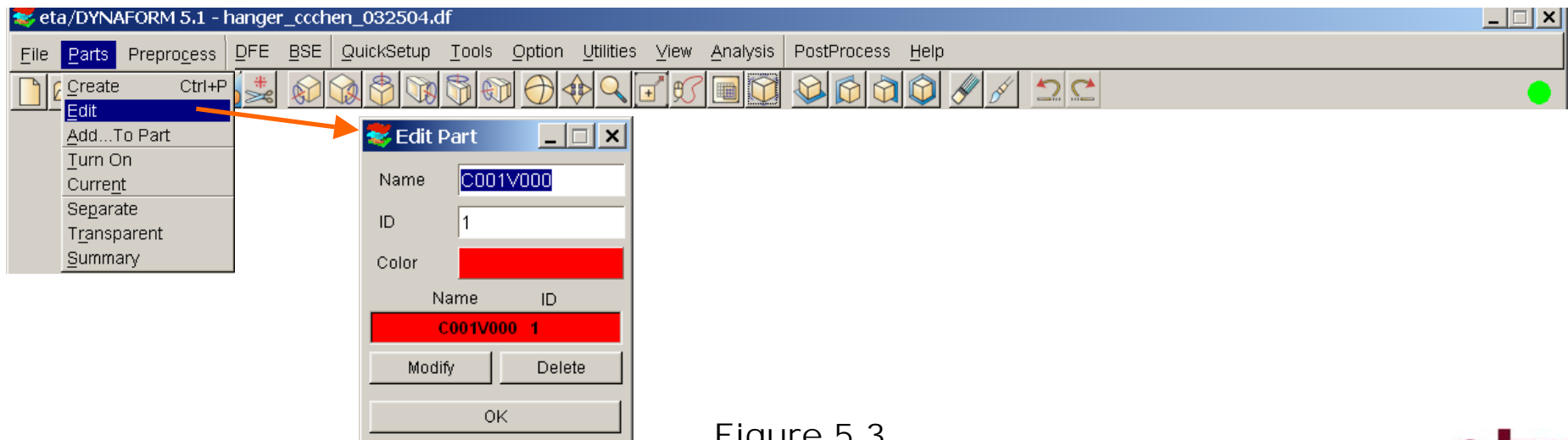



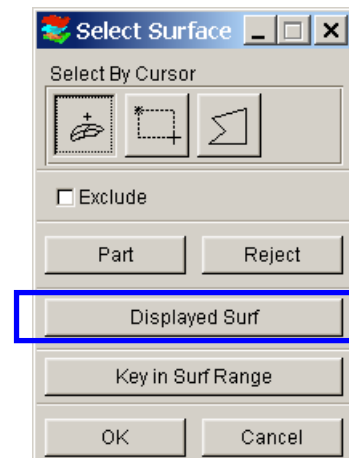
Figure 5.3

iv. Auto-Meshing the surfaces

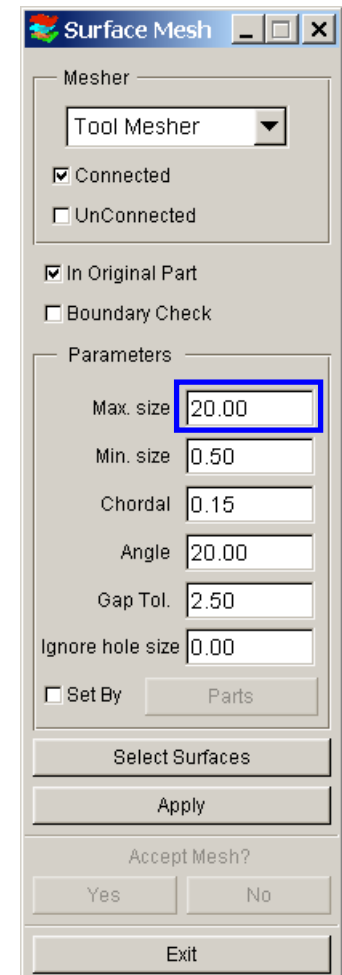
- a) Select **TOOL MESH** (See Figure 5.4a)
- b) Click **Displayed Surf.** to highlight all surfaces (See Figure 5.4b)
- c) Click **OK** to accept surfaces
- d) Select **Tool Mesher** (See Figure 5.4c)
- e) Key in Max. Size, **20.00** (mm)
- f) Click on **Apply**
- g) Click **Yes** to accept mesh
- h) Click **Exit** to dismiss Surface Mesh dialog window
- i) See Figure 5.5
- j) Click on  to save the database



(a)



(b)

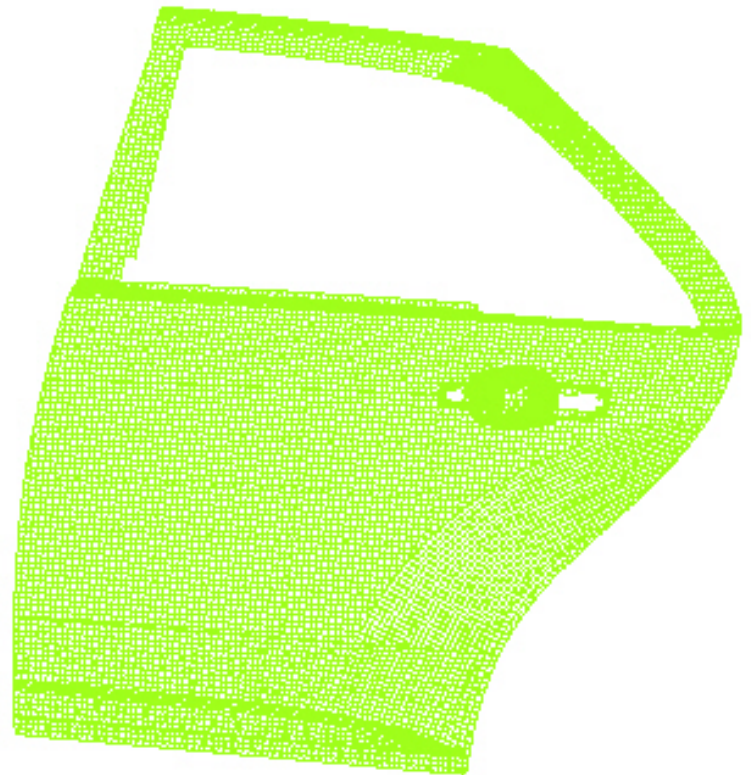


(c)

Figure 5.4



Model




Tool Mesh

Figure 5.5

Tutorial V

v. Check and repair meshes

- Select **MODEL CHECK**
- Click **Boundary Display** icon (Icon R1C2)
- Click on  (Clear highlight) to refresh screen
- Click **Plate Normal** icon (Icon R2C2)
- Read message window to make sure all normal is consistent
- Click **OK** to dismiss Model Check dialog window

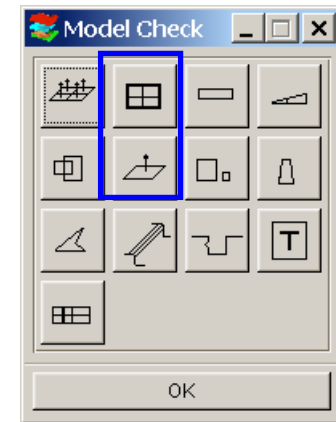


Figure 5.6

vi. Tipping

- Select **TIPPING** (Figure 5.7)
- Click **Yes** to assign the current part as Die (Figure 5.8)
- Toggle on "Undercut" (Figure 5.9)
- See Figure 5.10
- Click **Exit** to dismiss Tipping dialog window



Figure 5.7

Tutorial V

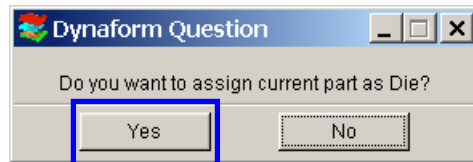


Figure 5.8

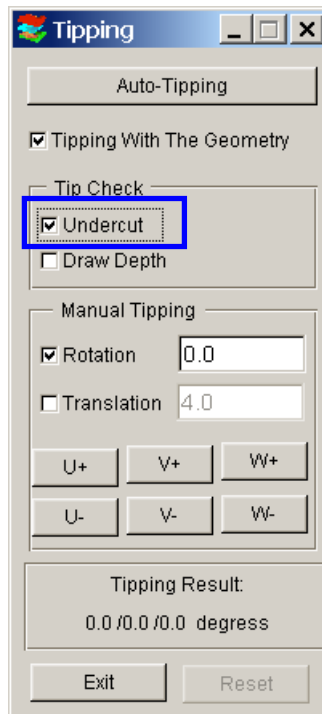
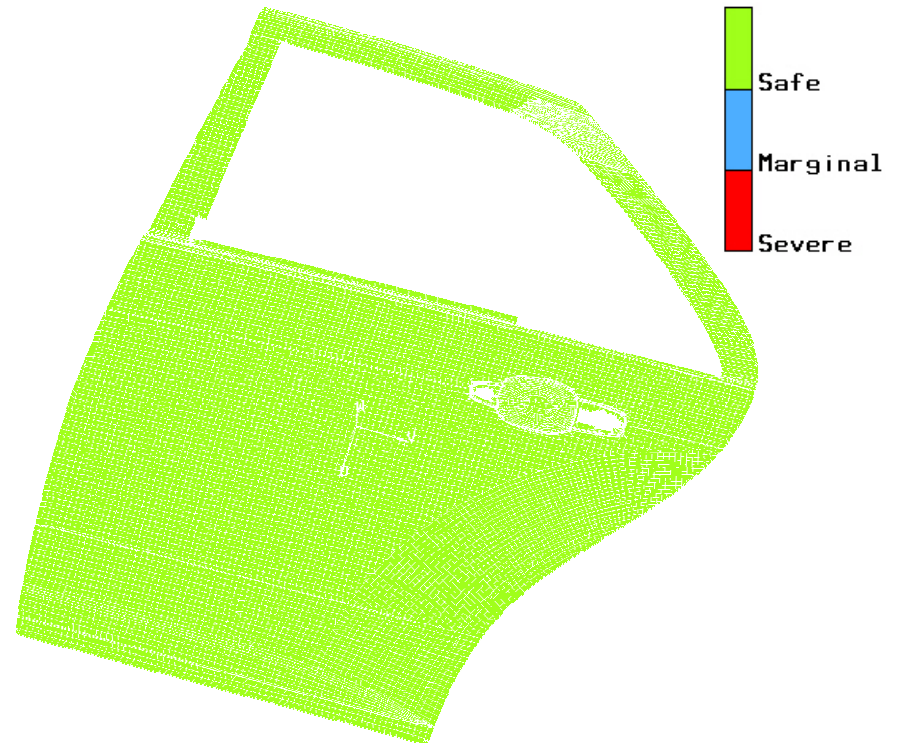


Figure 5.9



Tipping result

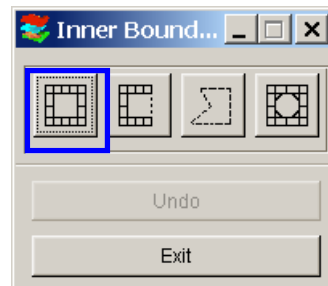
Figure 5.10

vii. Inner Fill: Close Curve

- Select **INNER FILL** (Figure 5.11a)
- Click on icon **Close Curve** (Figure 5.11b)
- Click on rotational and zooming functions to zoom out the hole region
- Select a node on inner hole boundary (Figure 5.12)
- Repeat (b) and (c) until all inner holes are filled



(a)



(b)

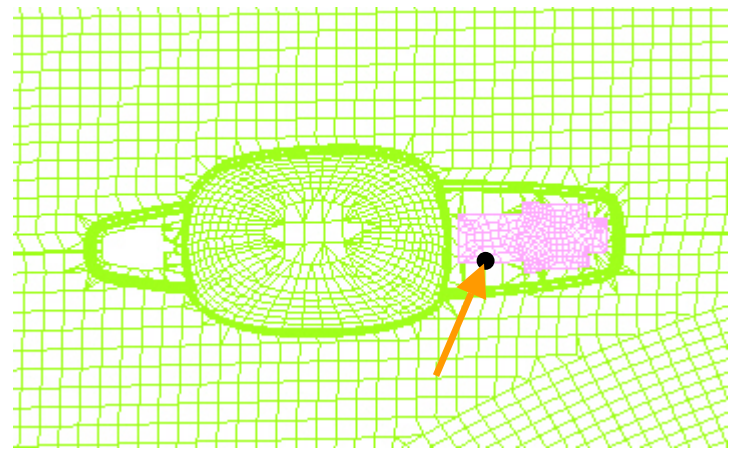



Figure 5.12

Figure 5.11

Tutorial V

viii. Inner Fill: Open Curve

- a) Click on icon **Open Curve** (Figure 5.13a)
- b) Click on **Multi-Point Region** (Figure 5.13b)
- c) Select elements around the open hole area (as shown in Figure 5.14a)
- d) Click **OK** to accept element selection
- e) Select **CREATE A NEW LINE** to create the boundary line for open curve fill (See Figure 5.14b)
- f) Pick two nodes to define the line segment (See Figure 5.14c)
- g) Click **Ok** to accept nodes selection
- h) Click **Yes** to accept inner fill surface
- i) See Figure 5.14c
- j) Repeat steps (a) to (d) until all open holes are filled
- k) See Figure 5.15
- l) Click **Exit** to dismiss the Inner Boundary Fill dialog window
- m) Click **Exit** to dismiss the DFE Preparation dialog window
- n) Click on  to save the database

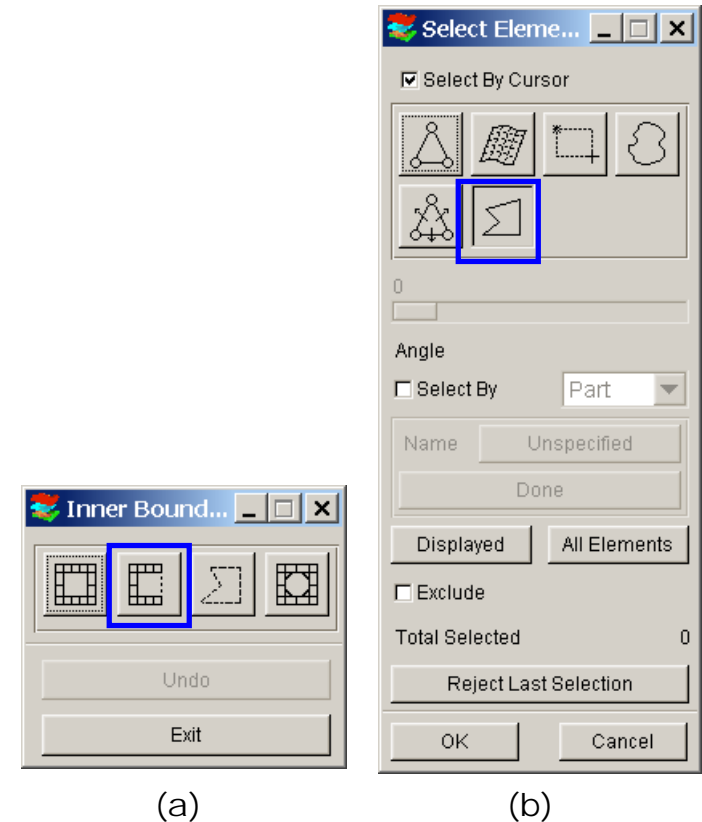
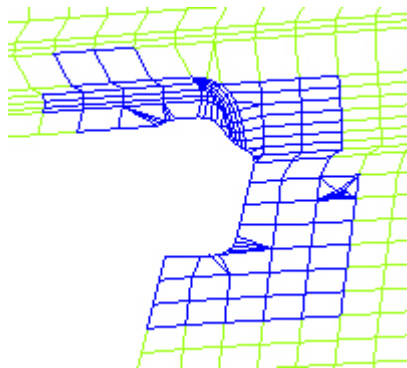


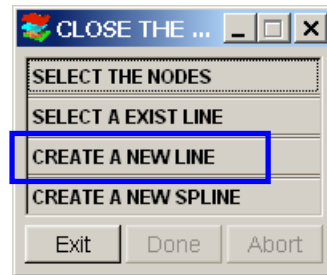
Figure 5.13

Tutorial V

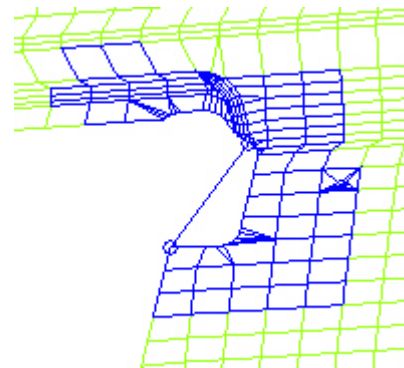


Select Elements

(a)

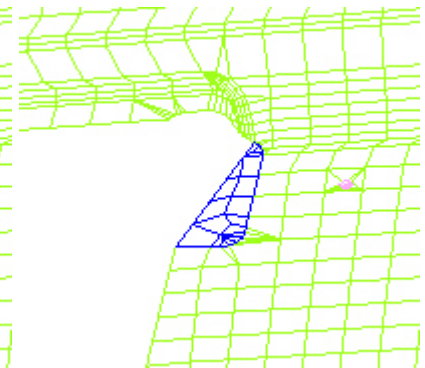


(b)



Create Line

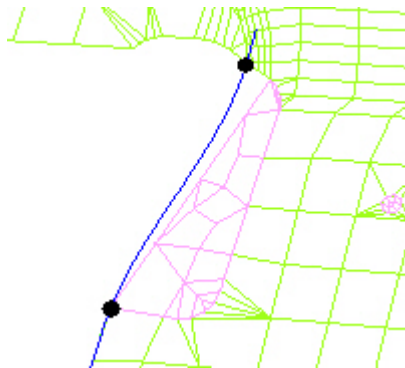
(c)



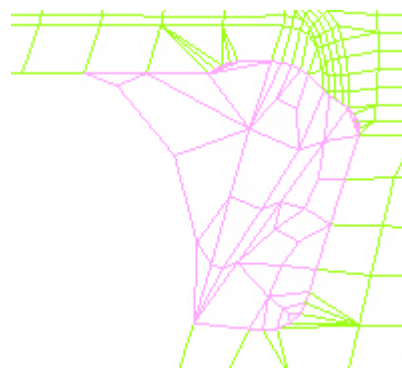
Fill Boundary

(d)

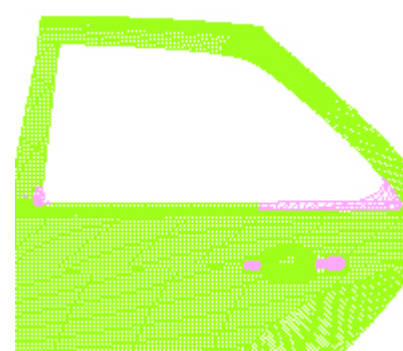
Figure 5.14



Create Spline



Fill Boundary



After INNER FILL

Figure 5.15

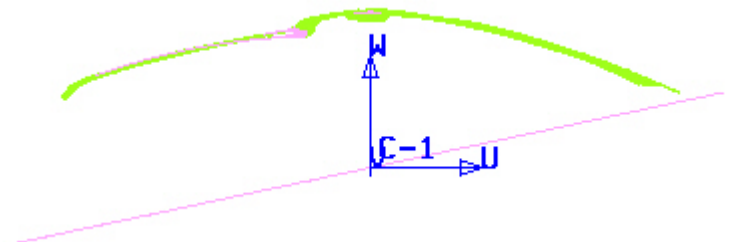
ix. Create inner binder

- 1) Click **DFE**
- 2) Select **Binder**
- 3) Select Binder Type, **Flat Binder**
- 4) Click **Create** to generate binder surfaces (Figure 5.16)
- 5) Click **Rotate Binder**
- 6) Toggle on “V” as axis of rotation
- 7) Key in rotation angle, **12°**
- 8) Toggle on “Reverse Operation”
- 9) Click **Apply** to rotate the binder
- 10) Click **Ok** to dismiss the dialog window
- 11) See Figure 5.17



Flat Binder

Figure 5.16




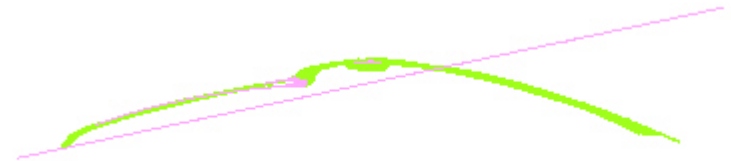
Rotate Binder

Figure 5.17

Tutorial V

Create Inner Binder continue ...

- 12) Click **Move Binder**
- 13) Toggle on “W”
- 14) Key in distance, **60.00** (mm)
- 15) Click **Apply**
- 16) Click **Ok** to dismiss the dialog window
- 17) See Figure 5.18
- 18) Click **Mesh Binder**
- 19) Key in Max and Min Element Size, **20.00** (mm)
- 20) Click **Ok**
- 21) Click **Exit** to dismiss Binder dialog window
- 22) Click on  to save the database



Move Binder

Figure 5.18


x. Create inner addendum

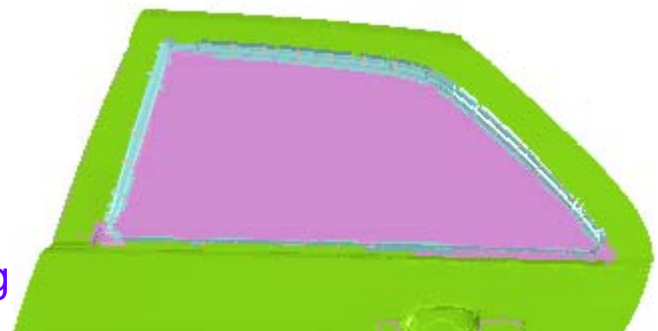
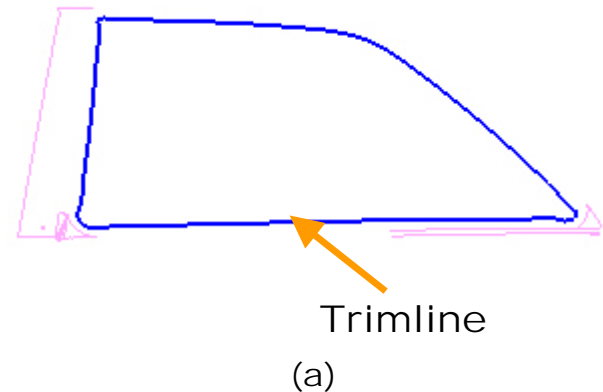
- 1) Click on *DFE*
- 2) Select *Addendum*
- 3) Click **Insert** (Master Profiles)
- 4) Select Profile Type **#2** (default)
- 5) Key in die and part radii, **5.00** (mm)
- 6) Key in wall angle, **5°**
- 7) Click **Ok** to dismiss Master Profile dialog window
- 8) Click **Insert** (Addendum)
- 9) Select type "Inner"
- 10) Toggle off "By Segment"
- 11) Click **Select Region**
- 12) Pick a node on the die boundary (See Figure 5.19)
- 13) Click **Apply**
- 14) Click **Close** to dismiss Insert Addendum dialog window
- 15) Click **Close** to dismiss Addendum Generation dialog window



Figure 5.19

xi. Inner binder trimming

- a) Click on *DFE*
- b) Select *Modification*
- c) Select **BINDER TRIM**
- d) Toggle off “Surface”
- e) Toggle on “Inner” as boundary type
- f) Click **Select** to select trimline (See Figure 5.20a)
- g) Click **Ok** to confirm the selection
- h) Click **Apply**
- i) Click **Yes** to accept the displayed line for binder trimming
- j) Click **Close** to dismiss Complete Binder dialog window
- k) Click **Exit** to dismiss DFE MODIFICATION dialog window
- l) Click on  to save the database



After trimming

(b)

Figure 5.20

xii. Create outer binder

1. Click *Parts*
2. Select *Edit*
3. Rename C_BINDER, POPLINE, ADDENDUM, TRIMOUT to INNBIND, INNPOP, INNADD, INNTRIM respectively
4. Click **OK** to dismiss Part Edit dialog window
5. Click *DFE*
6. Select *Binder*
7. Select Binder Type, **Two-Line Binder** (See Figure 5.21a)
8. Click **Define Binder Orientation** (See Figure 5.22a)
9. Click **LMB** to select reference point (See Figure 5.22b)
10. Click **Trim Reference Line**
11. Click **MMB**
12. Click **Create**
13. Click **No** to keep INNBIND (See Figure 5.23)
14. Click **Left view**
15. Click **Move Binder**
16. Toggle on "W"
17. Key in distance, **120.00** (mm) (See Figure 5.24)
18. Click **Apply**
19. Click **Ok**

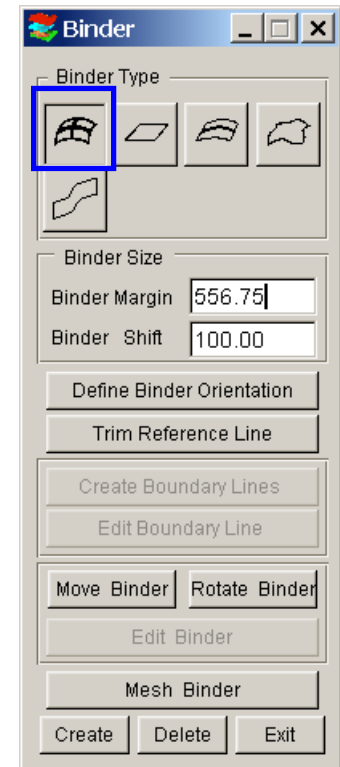
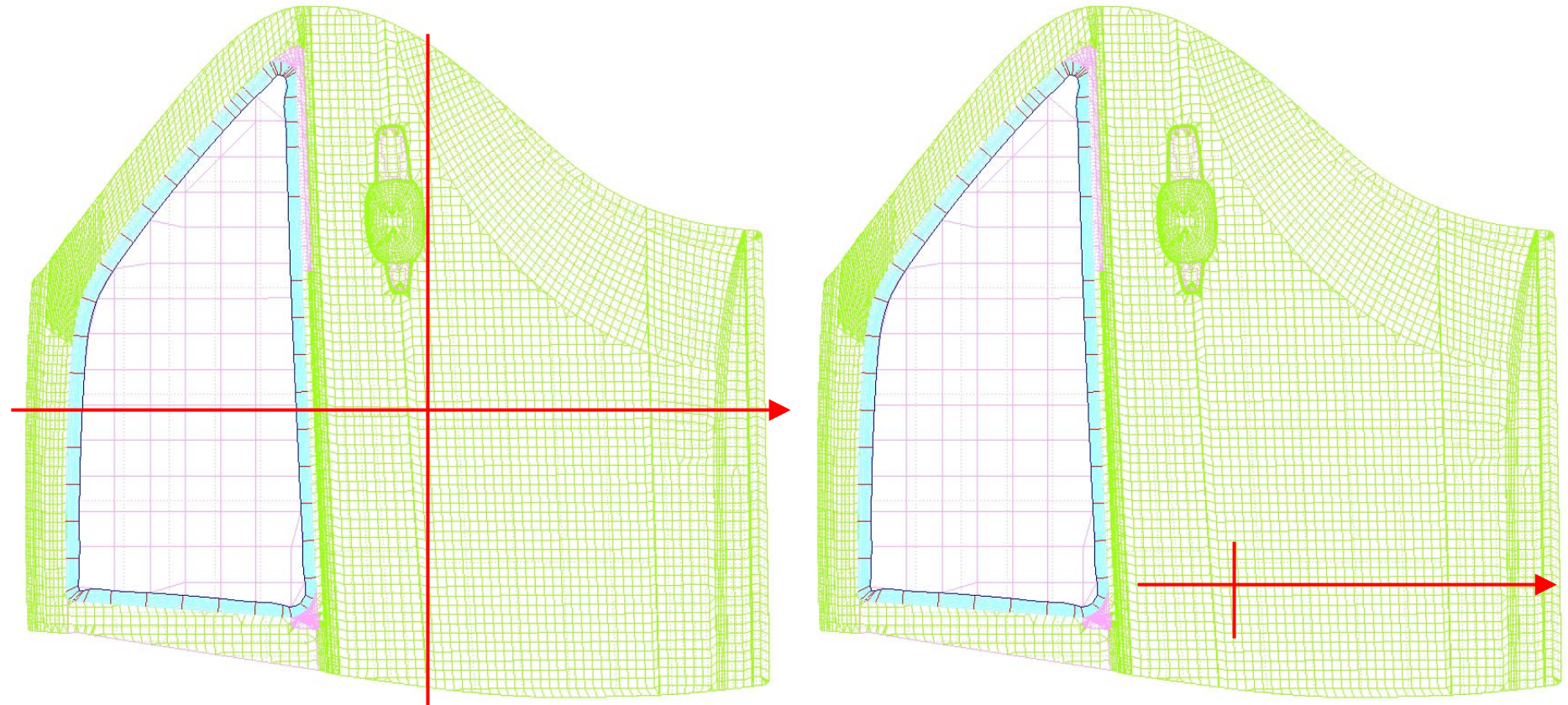


Figure 5.21



(a)

(b)

Figure 5.22

Tutorial V

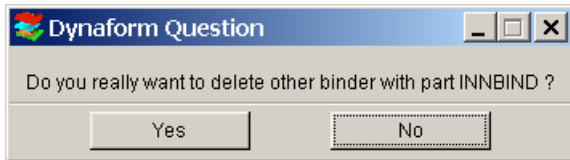


Figure 5.23

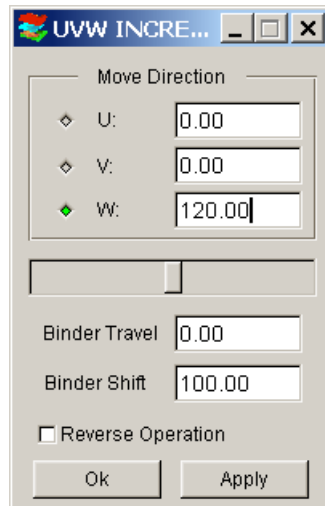


Figure 5.24

(a)

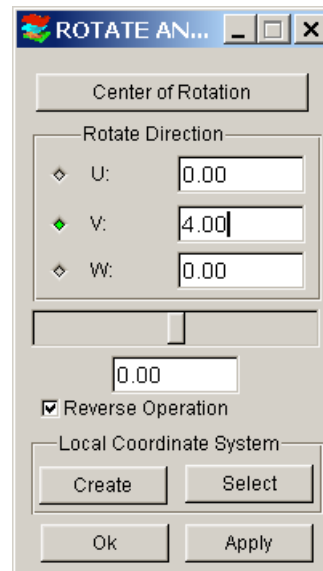


Figure 5.25

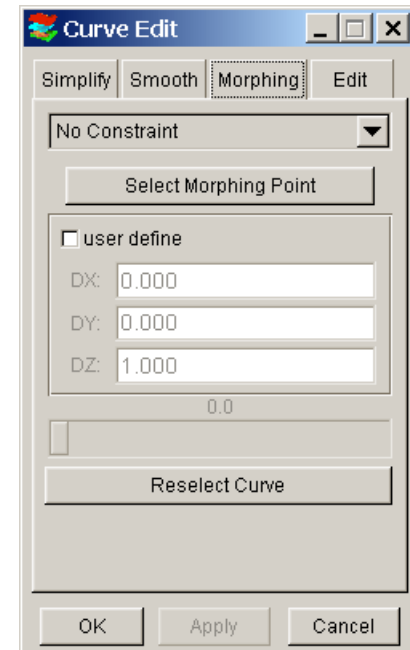



Figure 5.26

(b)

Tutorial V

Create outer binder continue ...

20. Click **Rotate Binder**
21. Toggle on "V"
22. Key in rotation angle, 4° (as shown in Figure
23. Click **Apply**
24. Click **Ok**
25. Click **Edit Binder** (See Figure 5.26)
26. Select section line on binder surface
27. Click on **Morphing** (See Figure 5.26)
28. Click **Select Morphing Point**
29. Select a mid point on the section line (Figure 5.27)
30. Move mouse cursor and click **RMB**
31. Click **Apply**
32. Click **Ok** to dismiss Curve Edit dialog window
33. Click **Ok** dismiss Move Binder dialog window
34. Click **Mesh Binder**
35. Key in Max and Min Element Size, **20.00** (mm)
36. Click **Ok**
37. Click **Exit** to dismiss Binder dialog window
38. Click on  to save the database
39. See Figure 5.28

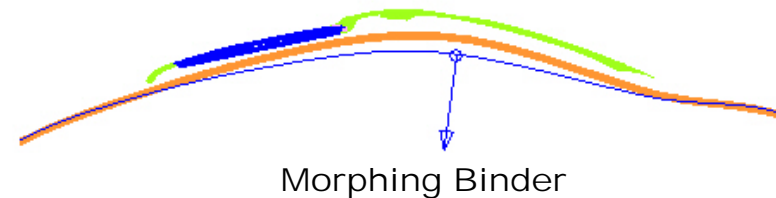


Figure 5.27

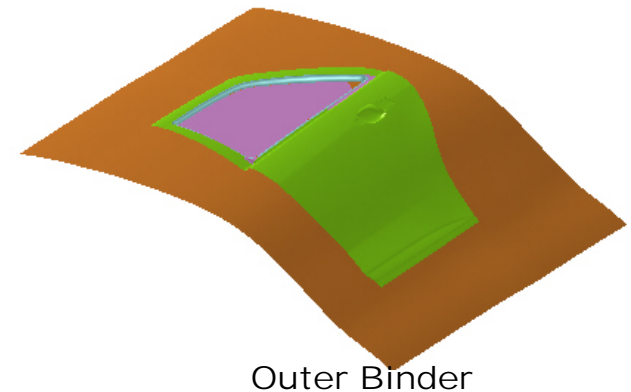


Figure 5.28

xiii. Create outer addendum

- a) Click on *DFE*
- b) Select *Addendum*
- c) Click **New** (Master Profiles)
- d) Select Profile Type, **#3**
- e) Key in die and part radii, **12.00** (mm)
- f) Key in wall angle, **10°**
- g) Click **Ok** to dismiss Master Profile dialog window
- h) Click **Assign** (Addendum)
- i) Select type “**Outer**”
- j) Toggle off “**By Segment**”
- k) Click **Apply**
- l) Click **Close** to dismiss Insert Addendum dialog window
- m) See Figure 5.29

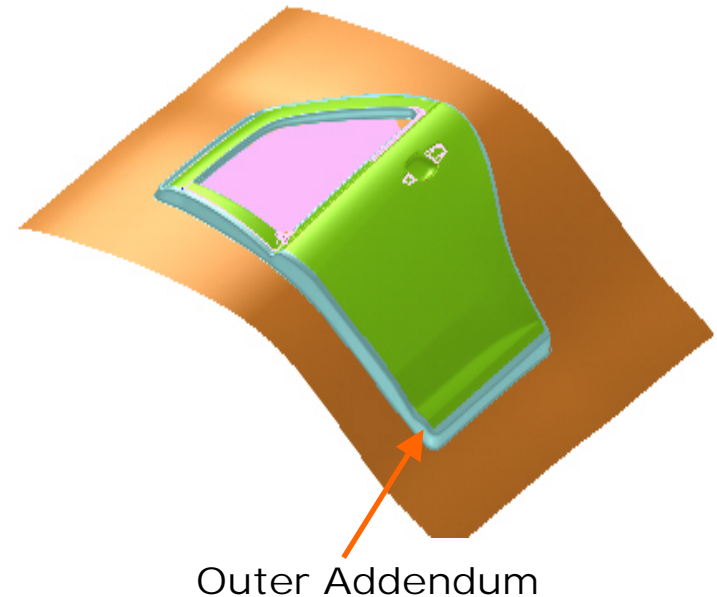
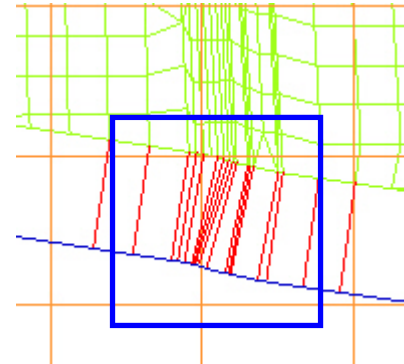


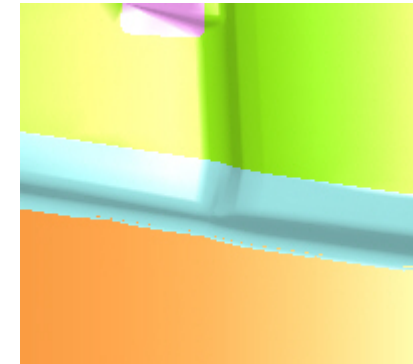
Figure 5.29

xiv. Adjust Profile Orientation

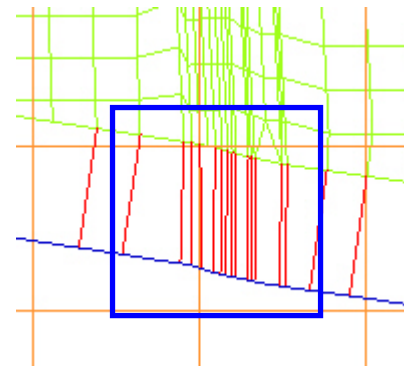
- a) Click **Orient** (Profile)
- b) Click on **Top view**
- c) Click on **Window zoom** to zoom in the region as shown in Figure 5.30
- d) Select a profile
- e) Move mouse cursor to a proper location
- f) Click **LMB** to complete
- g) Repeat steps (b) to (d) until the profiles are evenly spaced



Original Profile Orientation



Original Addendum



Adjusted Profile Orientation



Modified Addendum

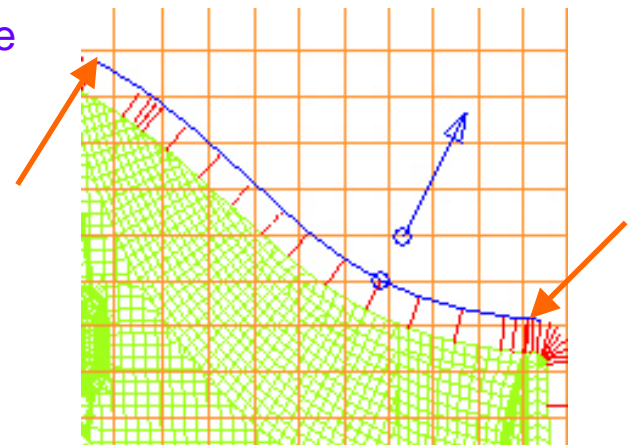
Figure 5.30

xv. Morphing POP Line

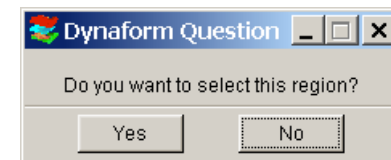
- a) Click **Morphing** (Addendum)
- b) Toggle on “POP line” (default) (Figure 5.31a)
- c) Click **Apply**
- d) Select starting and end profile (Figure 5.31b)
- e) Click **Yes** to accept the selected region (Figure 5.31c)
- f) Pick a point along the highlighted segment (Figure 5.31b)
- g) Move mouse cursor to a location
- h) Click **LMB**
- i) Click **Close** to update the addendum
- j) See Figure 5.32



(a)

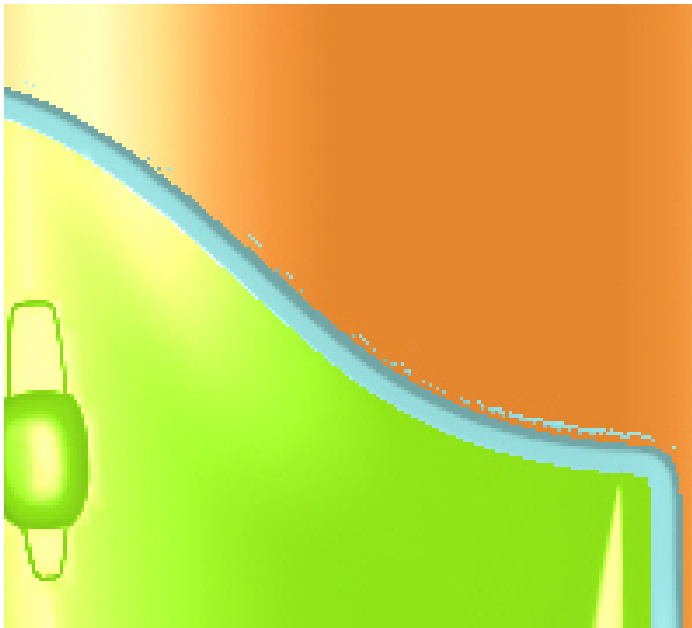


(b)

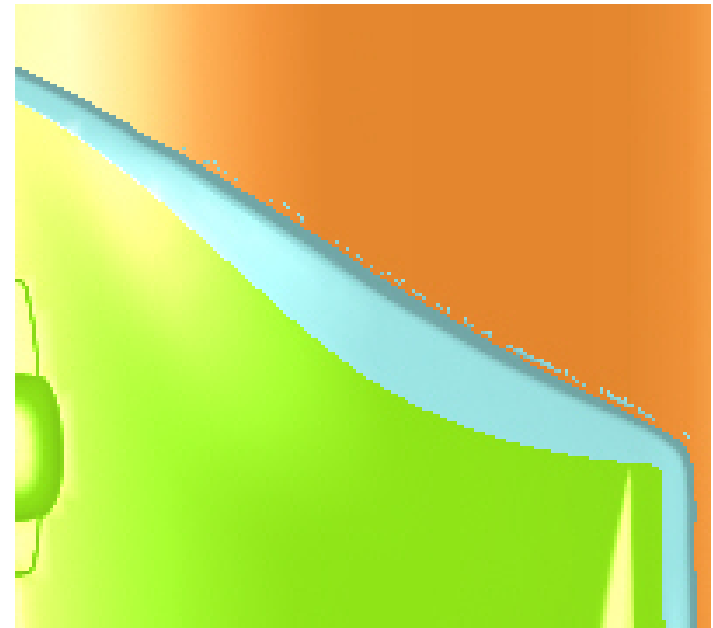


(c)

Figure 5.31




Addendum before morphing POP line



Addendum after morphing POP line

Figure 5.32

xvi. Outer binder trimming

- a) Click on **DFE**
- b) Select **Modification**
- c) Select **BINDER TRIM**
- d) Toggle off “**Surface**”
- e) Click **Select**
- f) Select trimline as shown in Figure 5.33
- g) Click **Ok** to confirm the selection
- h) Click **Apply**
- i) Click **Yes** to accept the displayed line for binder trimming
- j) Click **Close** to dismiss Complete Binder dialog window
- k) Turn off all parts and turn on C_BINDER
- l) Click **Exit** to dismiss DFE MODIFICATION dialog window
- m) Click on  to save the database

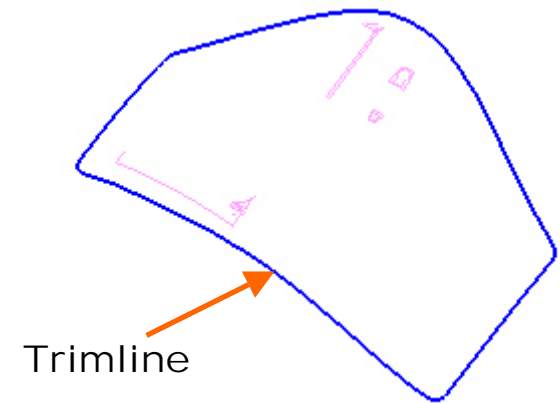


Figure 5.33

Tutorial VI


Fender to show Inner Fill, Conical Binder, Morphing, Addendum

Fender DFE procedures:

- i. Open and save database
- ii. Importing part geometry
- iii. Rename Part
- iv. Auto-Meshing the surfaces
- v. Check and repair meshes
- vi. Tipping
- vii. Inner Fill
- viii. Create binder
- ix. Move and rotate binder
- x. Morphing binder
- xi. Create addendum by segment
- xii. Merge POP Line
- xiii. Delete profile
- xiv. Modify profile
- xv. Create addendum surfaces
- xvi. Binder trimming

Tutorial VI

i. Open and save database

- a) Click on  to create a new database
- b) Click **No** to deny saving the database (See Figure 6.1)
- c) Click on *File* and select *Save As ...*
- c) Type in “doorrouter_(user name)_(date).df” as File Name
- d) Click on **Save**

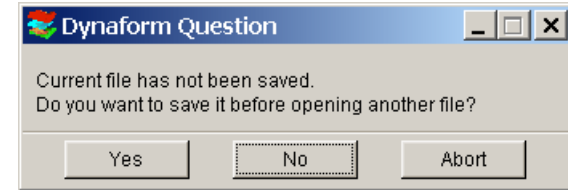


Figure 6.1

ii. Import part geometry

- a) Click on *DFE* (See Figure 6.2)
- b) Select *Preparation*
- c) Click **IMPORT**
- d) Select File location: *.../Tutorial6_Fender*
- e) Pick File name: *fender.igs*
- f) Click **Ok** to import the part geometry

Tutorial VI

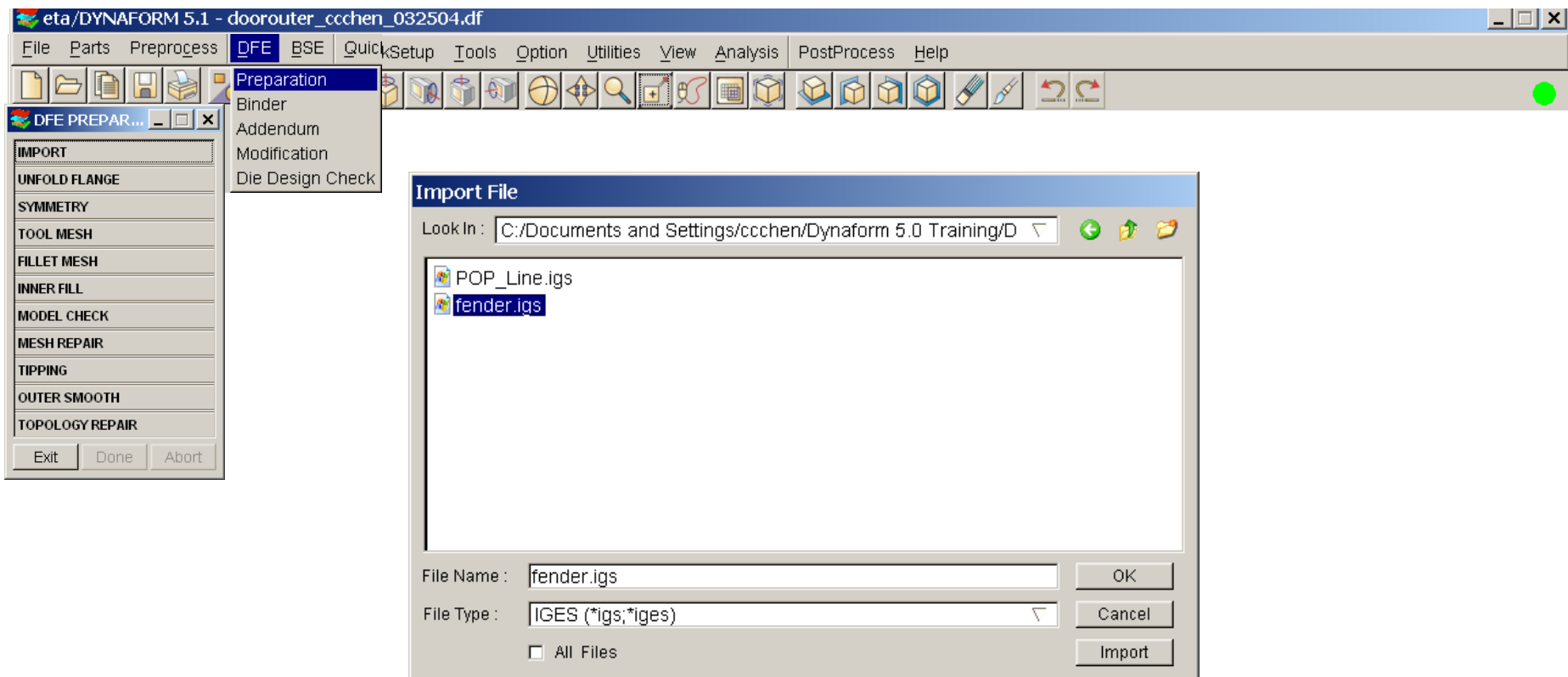


Figure 6.2

Tutorial VI

iii. Rename Part

- Click on **Parts** (See Figure 6.3)
- Select **Edit**
- Double click on the input box for Name to highlight Part C001V000 (as shown in Figure 6.3)
- Type in “**FENDER**”
- Click **Modify**
- Click **OK** to dismiss Edit Part dialog window

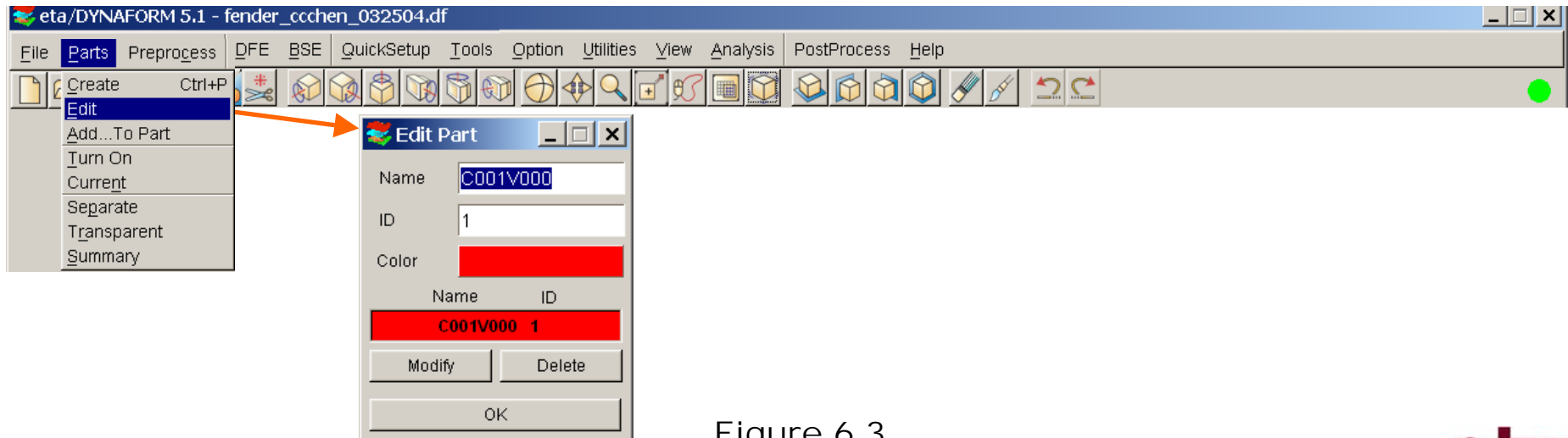



Figure 6.3

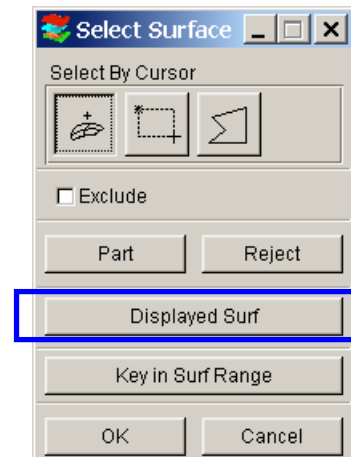
Tutorial VI

iv. Auto-Meshing the surfaces

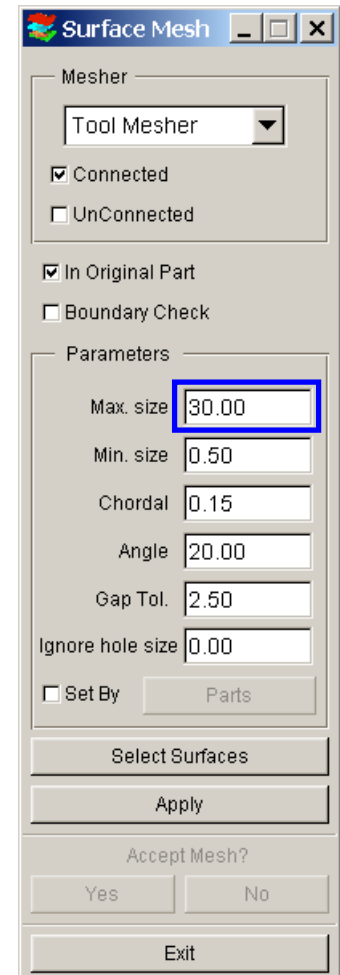
- Select **TOOL MESH** (See Figure 6.4a)
- Click **Displayed Surf.** to highlight all surfaces (See Figure 6.4b)
- Click **OK** to accept surfaces
- Select **Tool Mesher** (See Figure 6.4c)
- Key in Max. Size, **30.00** (mm)
- Click on **Apply**
- Click **Yes** to accept mesh
- Click **Exit** to dismiss Surface Mesh dialog window
- See Figure 6.5
- Click on  to save the database



(a)



(b)



(c)

Figure 6.4

Tutorial VI

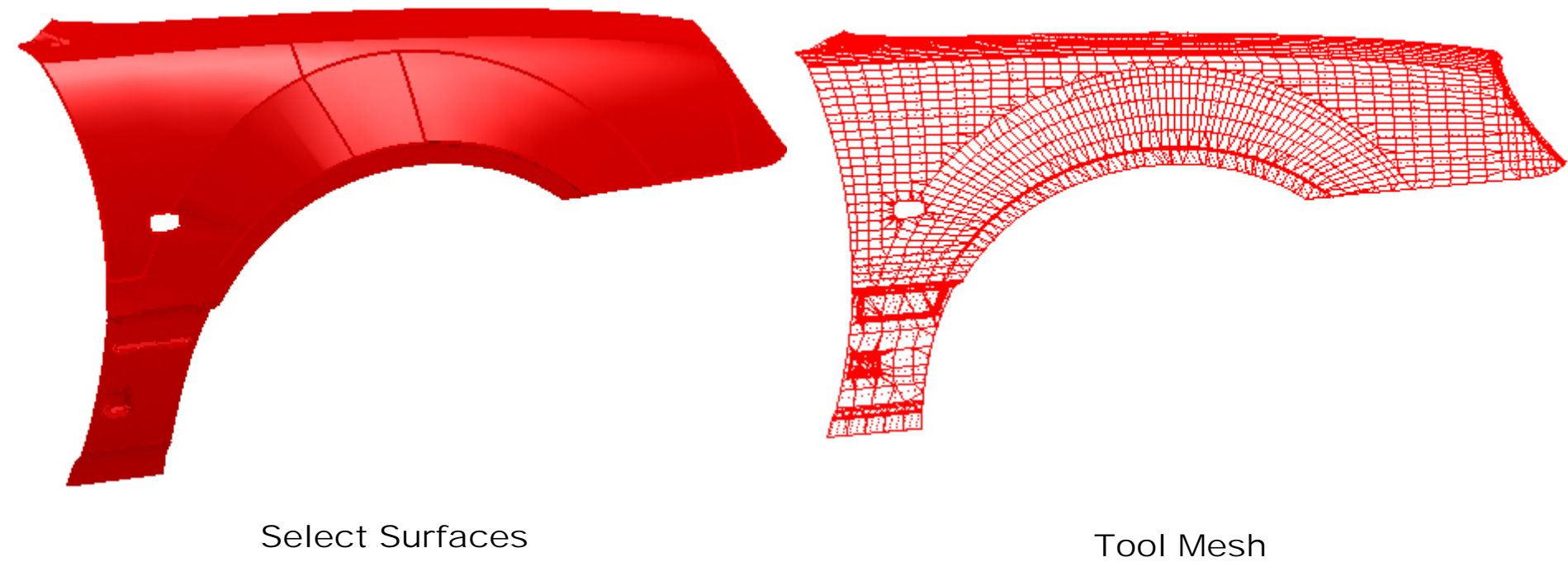



Figure 6.5

Tutorial VI

v. Check and repair meshes

- a) Select **MODEL CHECK** (Figure 6.6)
- b) Click **Boundary Display** icon (Icon R1C2)
- c) Click on  (Clear highlight) to refresh screen
- d) Click **Plate Normal** icon (Icon R2C2)
- e) Read message window to make sure all normal is consistent
- f) Click **Die Lock** icon (Icon R3C3)
- g) Pick an element on the part
- h) Click **No** (Figure 6.7)
- i) Click on **Window Zoom** to zoom out the undercut area
- j) Click **OK** to dismiss Model Check dialog window
- k) Select **MESH REPAIR** (Figure 6.8)
- l) Click **Delete Element** icon (Icon R1C3)
- m) Select undercut elements
- n) Click **Ok** to delete undercut elements

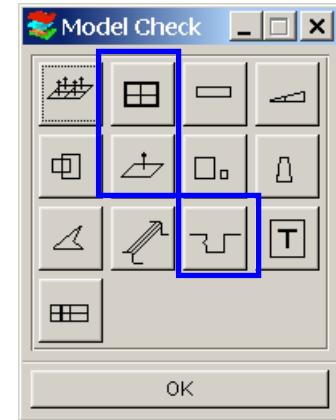


Figure 6.6

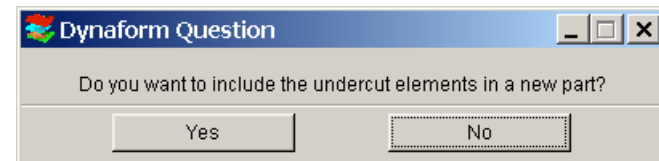




Figure 6.7

Tutorial VI

Check and repair meshes continue ...

- k) Click **Ok** to dismiss Mesh Repair dialog window
- l) Click on  to clear highlight
- m) Click on  to delete unreferenced nodes

vi. Tipping

- a) Select **TIPPING** (Figure 6.9)
- b) Click **Yes** to assign the current part as Die (Figure 6.10)
- c) Key in Rotation angle, **90°** (Figure 6.11)
- d) Click **U+** to rotate the Die along U-axis by 90°
- e) See Figure 6.12
- f) Click **Exit** to dismiss Tipping dialog window

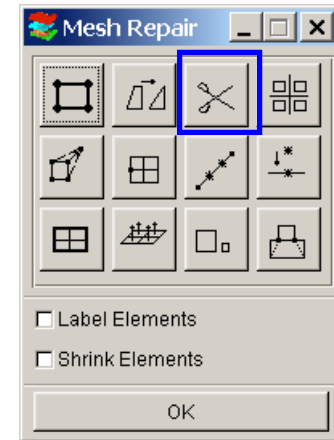


Figure 6.8



Figure 6.9

Tutorial VI

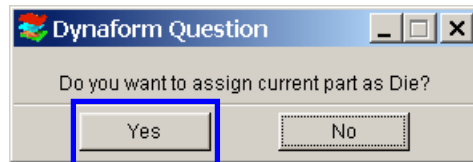


Figure 6.10

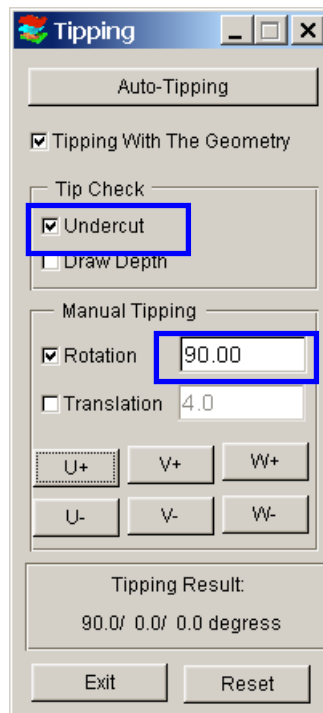
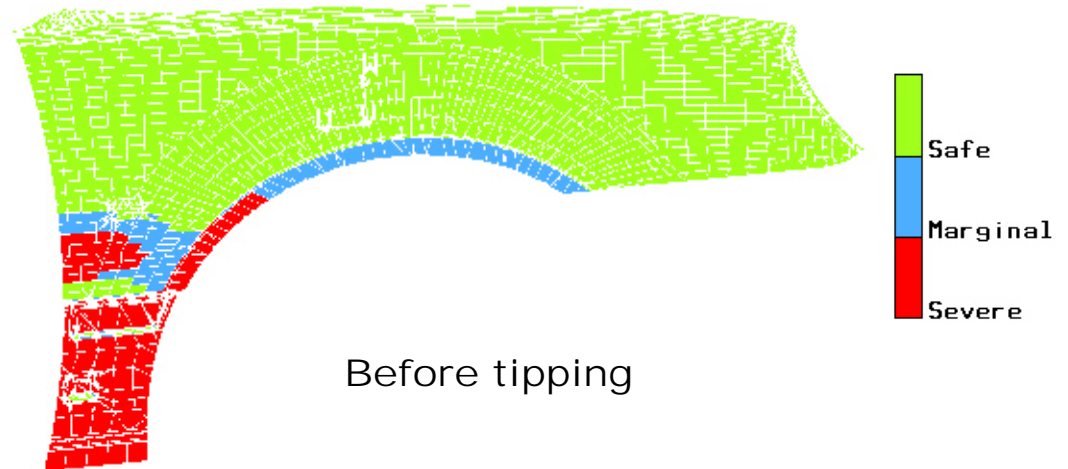
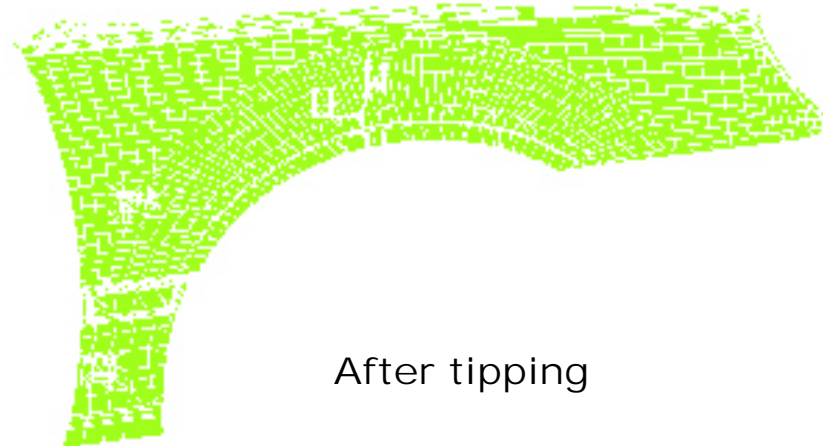


Figure 6.11



Before tipping



After tipping

Figure 6.12

Tutorial VI

vii. Inner Fill

- a) Click on *DFE*
- b) Select *Preparation*
- c) Select **INNER FILL**
- d) Click on **Auto Fill** icon (Figure 6.13)
- e) See Figure 6.14a
- f) Click **Exit** to dismiss Inner Boundary Fill dialog window
- g) Click **Exit** to dismiss DFE Preparation dialog window
- h) See Figure 6.14b

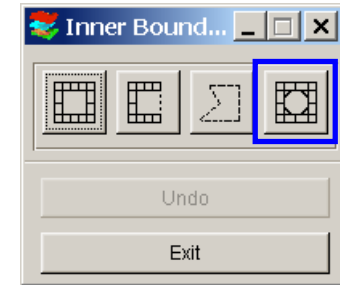
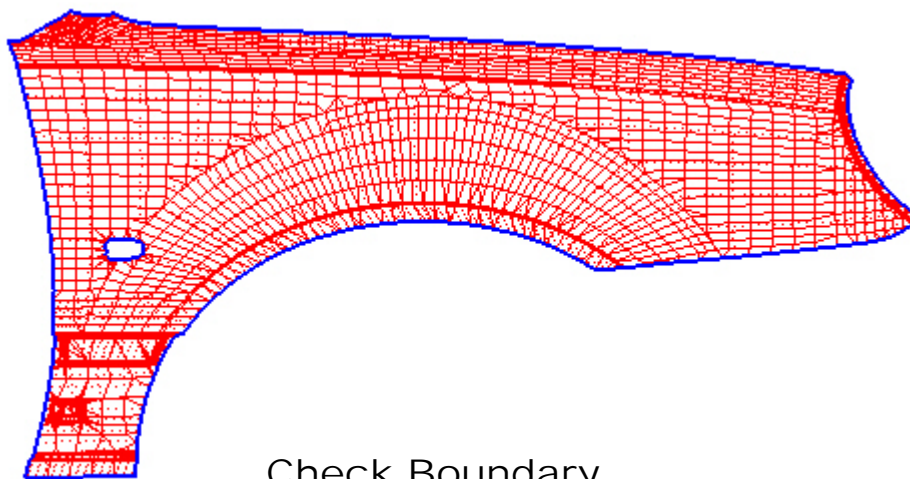
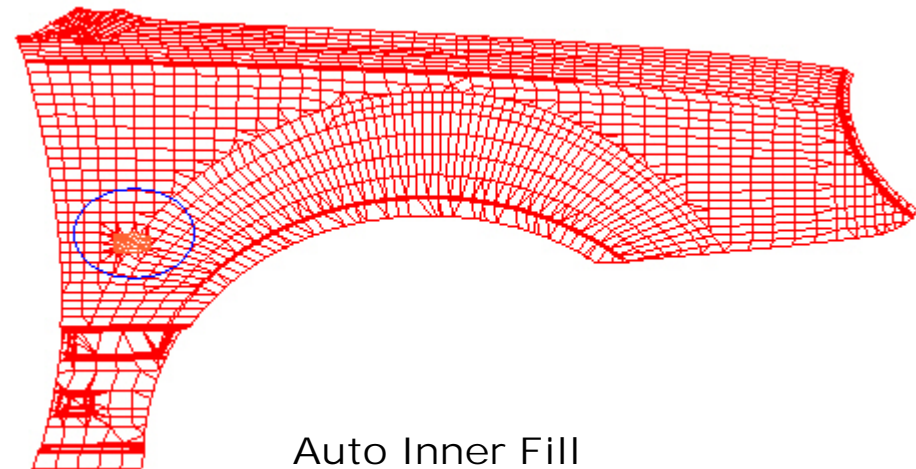


Figure 6.13



Check Boundary

(a)



Auto Inner Fill

(b)

Figure 6.14

Tutorial VI

viii. Create binder

- Click on *DFE*
- Select *Binder*
- Select Binder Type, **Conical Binder** (Figure 6.15)
- Click **Define Binder Orientation**
- Click and hold **LMB** at a selected location
- Move mouse to rotate crosshair
- Release **LMB** and click **MMB**
- Key in **Radius 1 (1260.00)** and **Radius 2 (1260.00)**
- Click **Create**
- See Figure 6.16

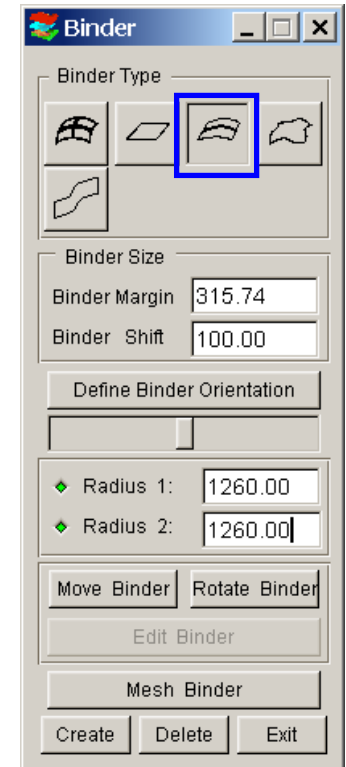


Figure 6.15

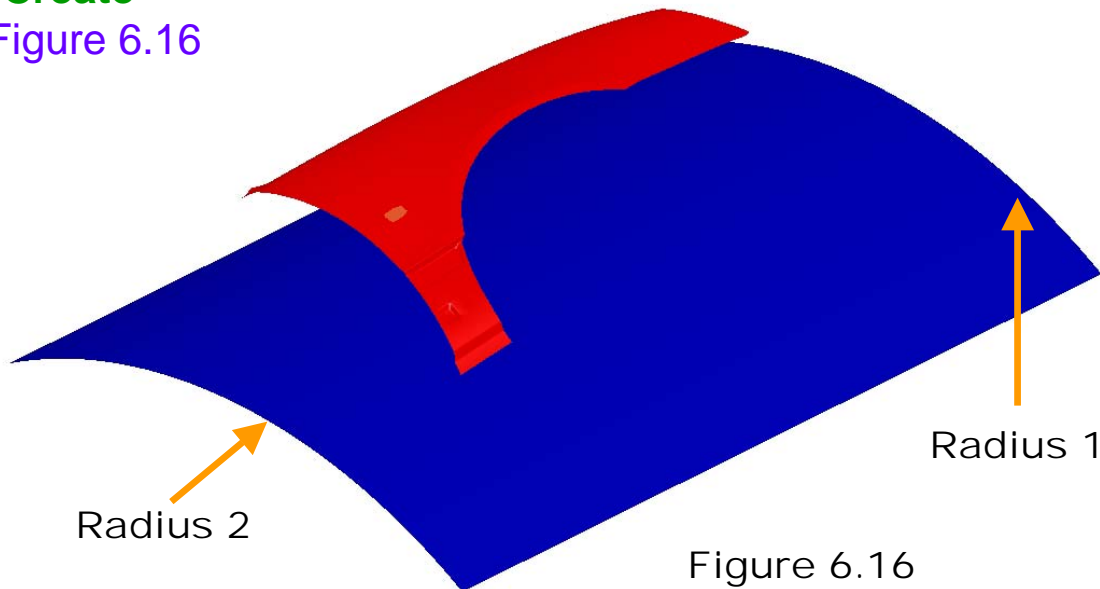


Figure 6.16

Tutorial VI

ix. Move and rotate binder

- a) Click **Rotate Binder**
- b) Toggle on “U” input box (Figure 6.17)
- c) Key in rotation angle, **8°**
- d) Toggle on “Reverse Operation”
- e) Click **Apply**
- f) Click **Ok** to dismiss the dialog window
- g) Click **Move Binder**
- h) Toggle on “W” (Figure 6.18)
- i) Key in distance, **200.00** (mm)
- j) Click **Apply**
- k) Click **Ok** to dismiss the dialog window
- l) Click on **Right view** icon
- m) See Figure 6.19

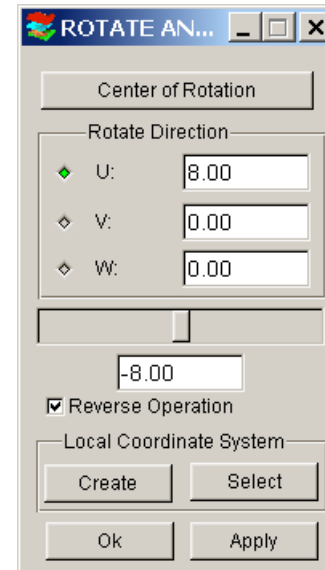


Figure 6.17

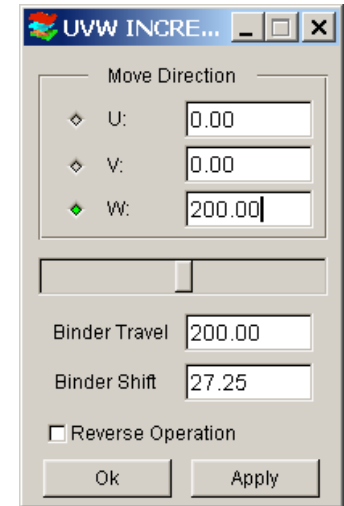


Figure 6.18

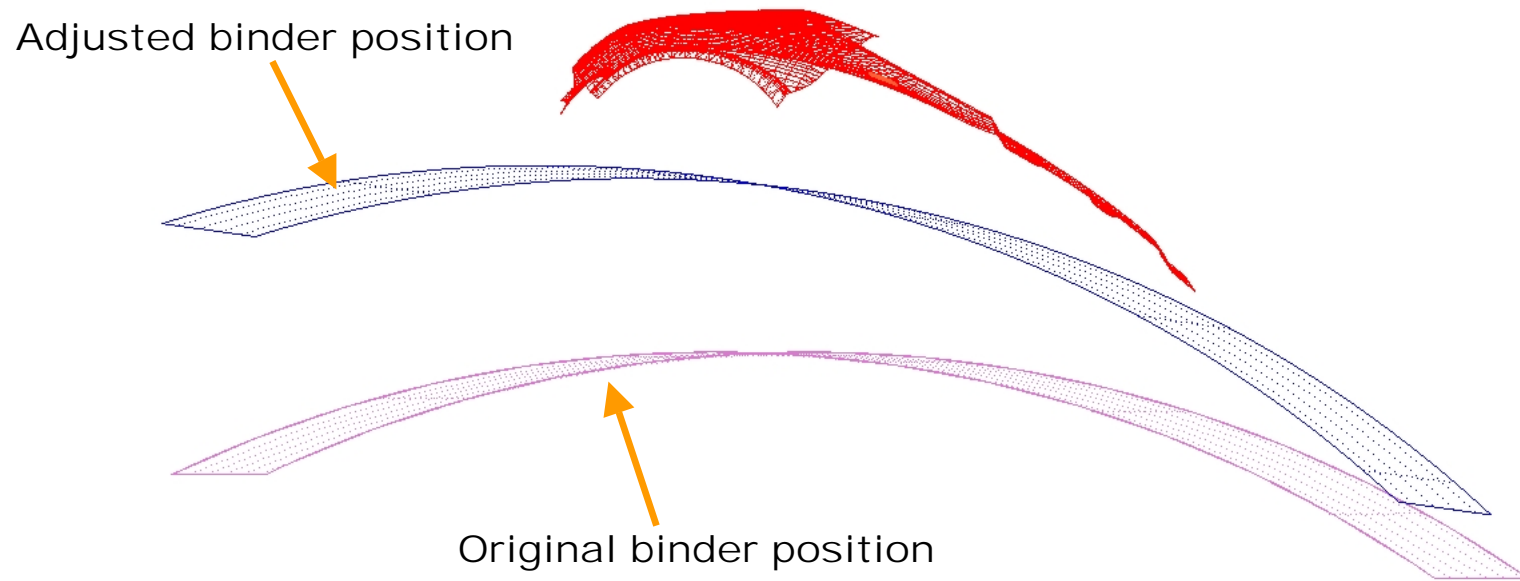
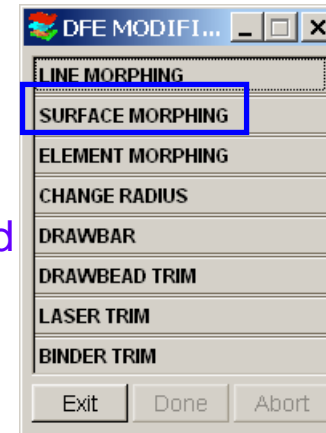


Figure 6.19

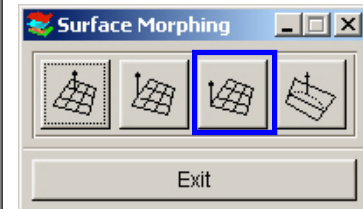
Tutorial VI

x. Morphing binder

- 1) Click on **DFE**
- 2) Select **Modification**
- 3) Select **Surfaces Morphing** (Figure 6.20a)
- 4) Four (4) surface morphing functions are provided to morph the binder surface
 - Corner Morphing
 - Edge Morphing
 - Interior Morphing
 - Section line morph
- 5) Click **Corner Morphing** (Figure 6.20b)
- 6) Click on **Left view** icon
- 7) Select binder surface (Figure 6.21)
- 8) Pick lower right corner of binder surface
- 9) Key in increment, **20.00** (mm)
- 10) Click (-) (as shown in Figure 6.21)
- 11) Click **Exit**



(a)



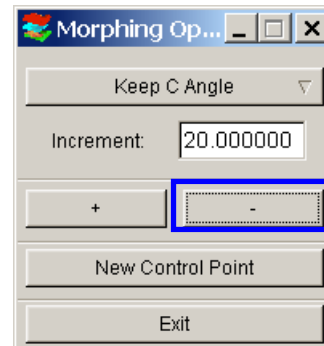
(b)

Figure 6.20

Tutorial VI

Note: Morphed shape is controlled by

- Fix the Center Angle, "C - Angle"
- Fix Edge Angle, "E-Angle"
- Allow Both C and E Angles to change



Binder surface

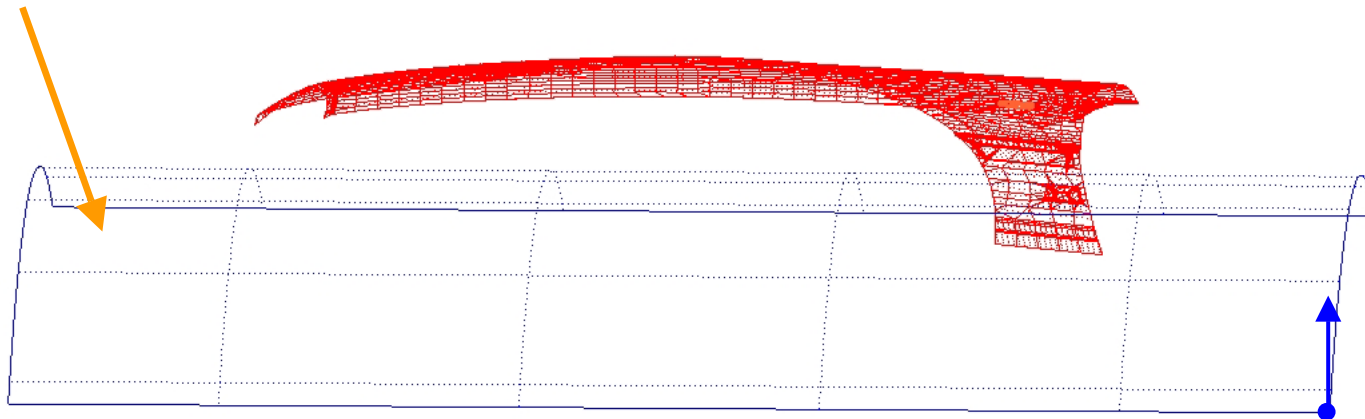



Figure 6.21

Tutorial VI

Morphing binder continue ...

- 12) Click **Exit** to dismiss Surface Morphing dialog window
- 13) Click **Exit** to dismiss DFE Modification dialog window
- 14) Click on *DFE*
- 15) Select *Binder*
- 16) Click **Mesh Binder**
- 17) Key in Max and Min Element Size, **20.00** (mm)
- 18) Click **Ok**
- 19) Click **Exit** to dismiss Binder dialog window
- 20) Click on  to save the database
- 21) See Figure 6.22

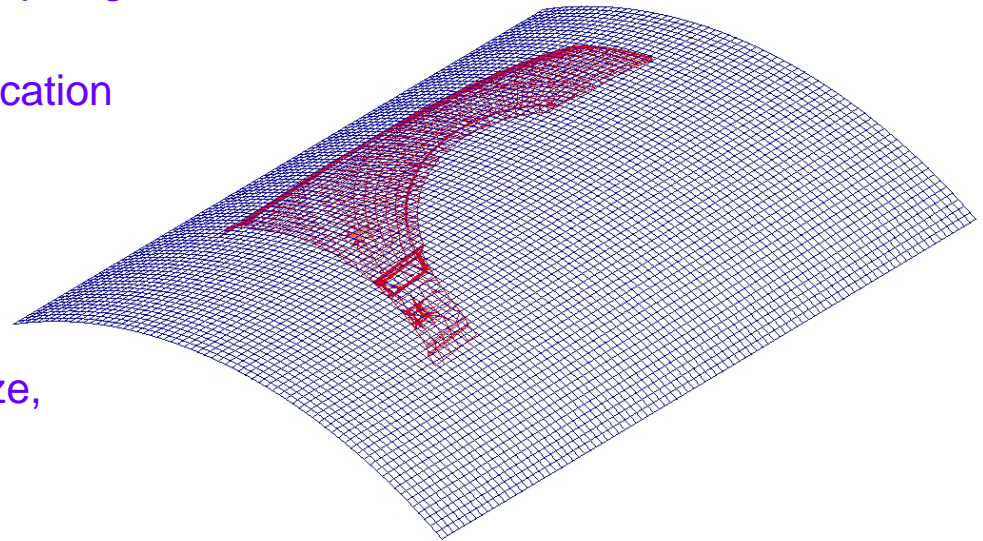


Figure 6.22

xi. Create addendum by segment

Notes:

- a) User create multiple segments using different master profiles
 - Define the PO Line Width (may be estimated)
 - Project Punch Opening Plus Line (POP Line) per the tangent angle from the edge of the die
 - Automatically generate like-to-like profiles within the given segment
- b) Using Manual profile editing capability
 - Delete segments/profiles
 - Add segments/profiles
 - Morph one profile and propagate the change to the surrounding profiles, also POP Line
- c) Morphing and Smoothing POP line
 - POP Line and Profiles will be updated for any and every editing
 - It takes time, be patient for the updates

Tutorial VI

xi. Create addendum segment

1. Click on **DFE**
2. Select **Addendum**
3. Click **New** (Master Profile)
4. Select Profile Type, **#4** (Figure 6.23)
5. Key in **Die**, **Bar**, **CBar** and **Part** radii, as shown in Figure 6.23
6. Key in **CBar** width
7. Move the dashed blue lines to adjust “Width” and “Height”
8. Click **Apply**
9. Click **Ok** to dismiss Master Profile dialog window
10. Click **Assign** (Addendum)
11. Select type, **Outer**
12. Toggle on “By Segment”
13. Click **Select Region**
14. Pick two nodes on boundary to define region (See Figure 6.24a)
15. Click **Apply**
16. Click **Close**



Profile Type: **#4** (selected)

Operation: **Length 149.6**

Parameters		Width	Plus
Die: 15.000	Angle: 15.000	PO: 77.529	Part: 0.000
Bar: 50.000	Bar: 15.000	Bar: 71.000	Die: 0.000
CBar: 15.000	CBar: 15.000	Height: -4.000	Slope: 0.000
Part: 5.000	Part: 90.000	CBar: -27.000	CBar: 0.000

Buttons: Ok, Apply, Cancel

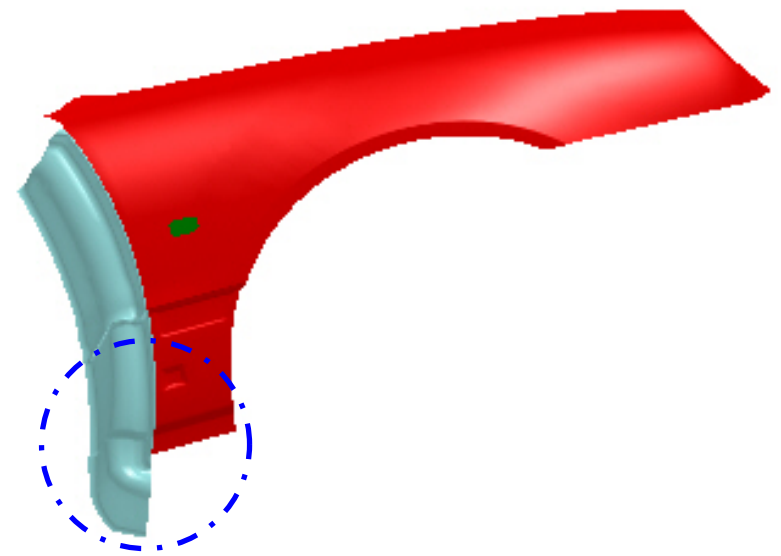
1st master profile

Figure 6.23



1st addendum segment

(a)



2nd addendum segment

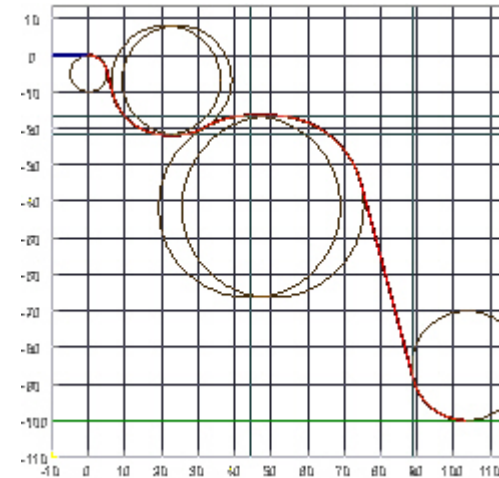
(b)

Figure 6.24

Tutorial VI

Create addendum segment continue ...

17. Click **New** (Master Profile) to insert master profile for second addendum
18. Select Profile Type, **#6** (Figure 6.25)
19. Key in **Die**, **Bar**, **CBar** and **Part** radii
20. Key in **CBar** width
21. Move the dashed blue lines to adjust “Width” and “Height”
22. Click **Apply**
23. Click **Ok** to dismiss Master Profile dialog window
24. Click **Assign** (Addendum)
25. Select type, **Outer**
26. Toggle on “By Segment”
27. Click **Select Region**
28. Pick two nodes on boundary to define region (See Figure 6.24b)
29. Click **Apply**
30. Click **Close**



Profile Type		Operation		Length 171.7
Parameters				
Radius	Angle	Width	Plus	
Die: 15.000	Wall: 15.000	PO: 89.030	Part: 0.000	
Bar: 25.000	Bar: 15.000	Bar: 44.085	Die: 0.000	
CBar: 15.000	CBar: 15.000	Bar: -16.490	Slope Bar: 0.000	
Part: 5.000	Part: 90.000	CBar: -21.786	CBar: 0.000	
Ok		Apply		Cancel

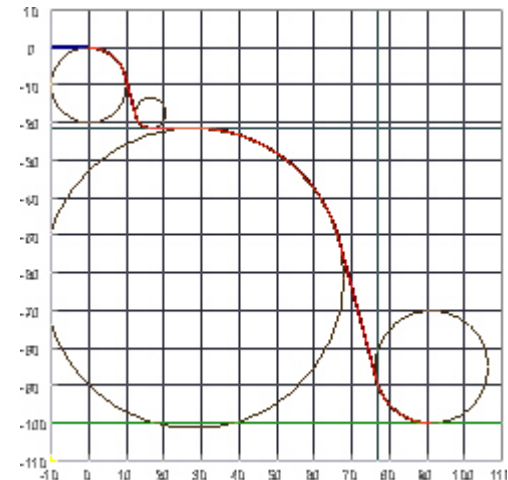
2nd master profile

Figure 6.25

Tutorial VI

Create addendum segment continue ...

31. Click **New** (Master Profile) to insert master profile for third addendum
32. Select Profile Type, **#4** (Figure 6.26)
33. Key in **Die**, **Bar**, **Cbar** and **Part** radii
34. Key in **CBar** width
35. Move the dashed blue lines to adjust “Width” and “Height”
36. Click **Apply**
37. Click **Ok** to dismiss Master Profile dialog window
38. Click **Assign** (Addendum)
39. Select type, **Outer**
40. Toggle on “By Segment”
41. Click **Select Region**
42. Pick two nodes on boundary to define region (See Figure 6.27a)
43. Click **Apply**
44. Click **Close**



Profile Type		Operation		Length 152.4
Parameters				
Radius	Angle	Width	Plus	
Die: 15.000	Wall: 15.000	PO: 76.715	Part: 0.000	
Bar: 40.000	Bar: 15.000	Bar: 71.000	Die: 0.000	
CBar: 4.000	CBar: 15.000	Height: -4.000	Slope: 0.000	
Part: 10.000	Part: 90.000	CBar: -21.400	CBar: 0.000	
Ok		Apply		Cancel

3rd master profile

Figure 6.26

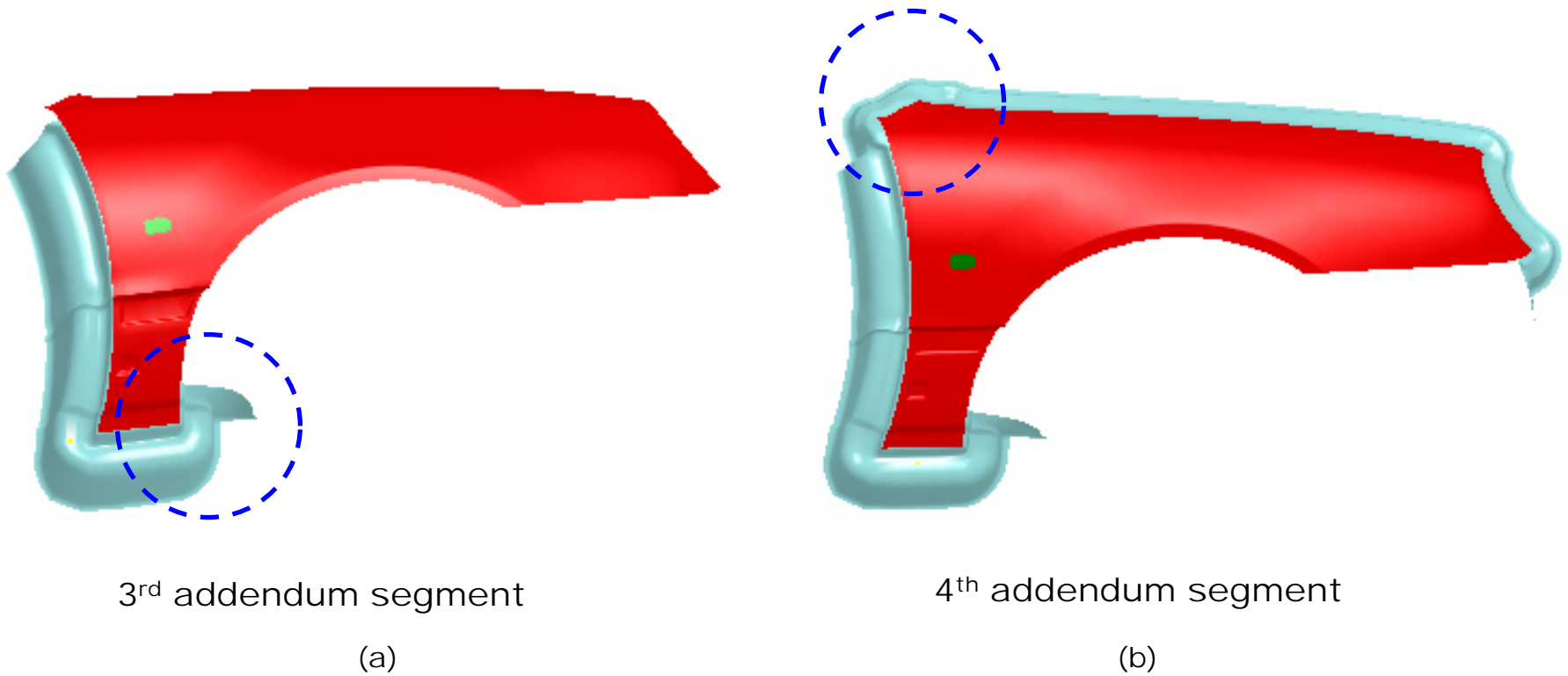


Figure 6.27

Tutorial VI

Create addendum segment continue ...

45. Click **New** (Master Profile) to insert master profile for forth addendum
46. Select Profile Type, **#3** (Figure 6.28)
47. Key in **Die**, **Bar**, and **Part** radii
48. Key in **Part Plus**
49. Move the dashed blue lines to adjust “Width” and “Height”
50. Click **Apply**
51. Click **Ok** to dismiss Master Profile dialog window
52. Click **Assign** (Addendum)
53. Select type, **Outer**
54. Toggle on “By Segment”
55. Click **Select Region**
56. Pick two nodes on boundary to define region (Figure 6.27b)
57. Click **Apply**
58. Click **Close**



Radius		Angle		Width		Plus	
Die:	15.000	Wall:	15.000	PO:	47.149	Part:	12.000
Bar:	10.000	Bar:	15.000	Bar:	80.000	Die:	0.000
CBar:	10.000	CBar:	15.000	Height:	-40.933	Slope:	0.000
Part:	15.000	Part:	45.000	CBar:	-30.000	Bar:	0.000

Length 122.3

Ok Apply Cancel

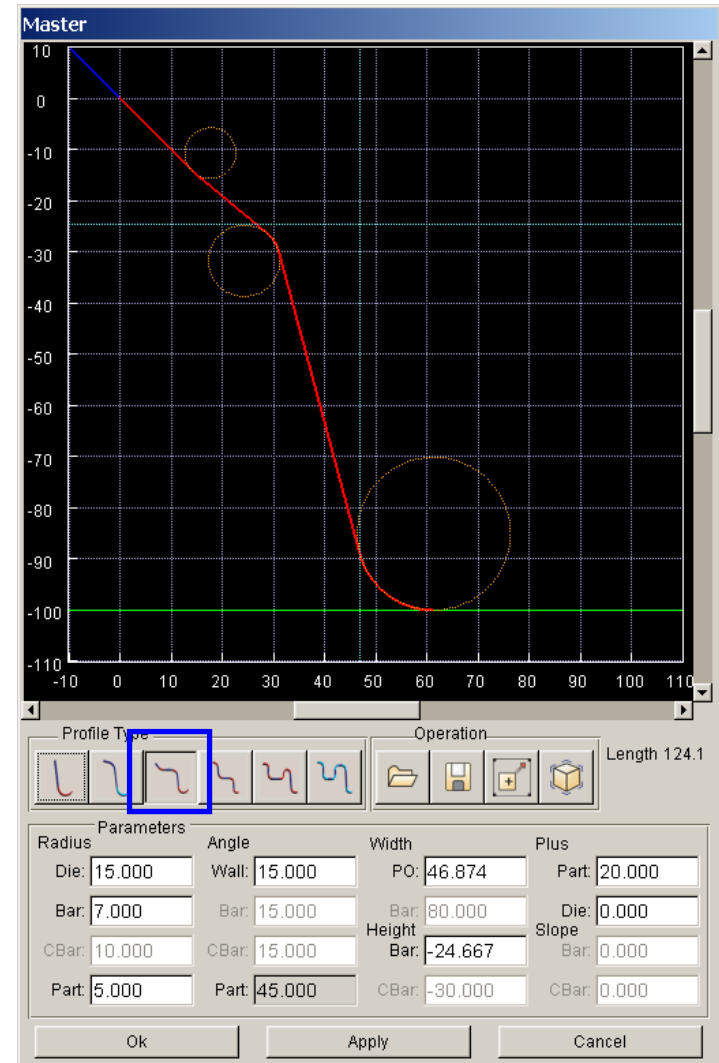
4th master profile

Figure 6.28

Tutorial VI

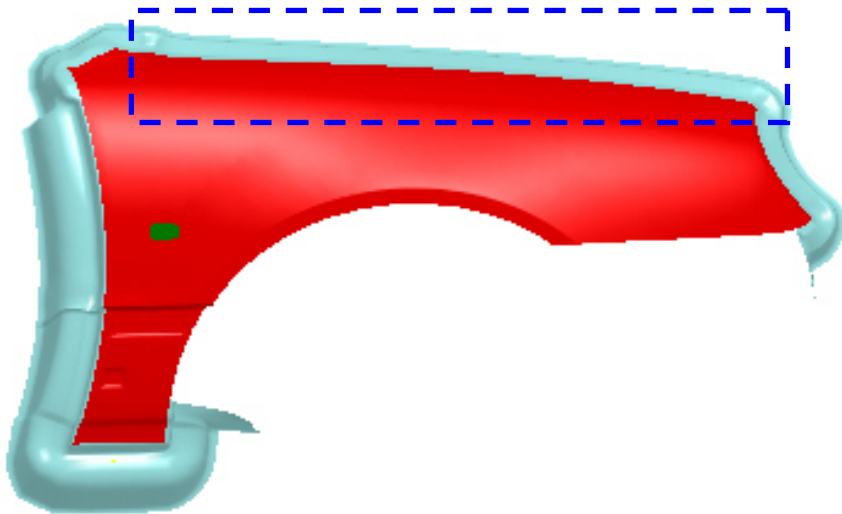
Create addendum segment continue ...

59. Click **New** (Master Profile) to insert master profile for fifth addendum
60. Select Profile Type, **#3** (Figure 6.29)
61. Key in **Die**, **Bar**, and **Part** radii
62. Key in **Part Plus**
63. Move the dashed blue lines to adjust “Width” and “Height”
64. Click **Apply**
65. Click **Ok** to dismiss Master Profile dialog window
66. Click **Assign** (Addendum)
67. Select type, **Outer**
68. Toggle on “By Segment”
69. Click **Select Region**
70. Pick two nodes on boundary to define region (Figure 6.30a)
71. Click **Apply**
72. Click **Close**



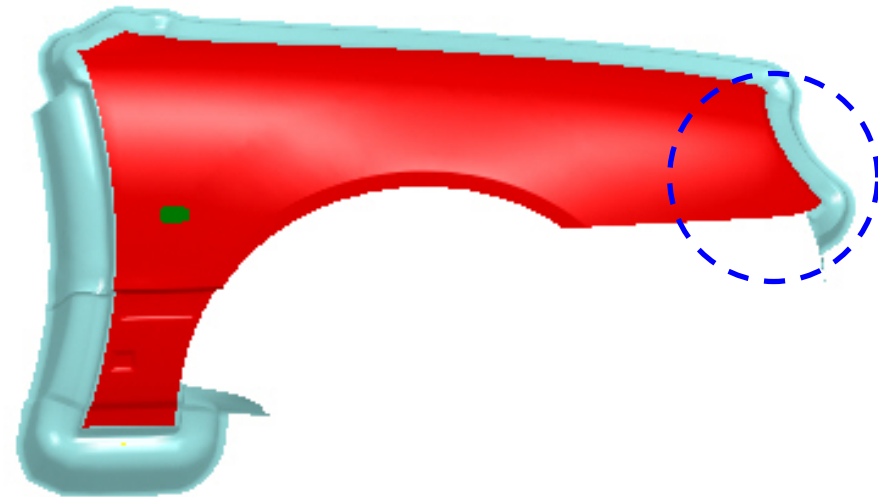
5th master profile

Figure 6.29



5th addendum segment

(a)



6th addendum segment

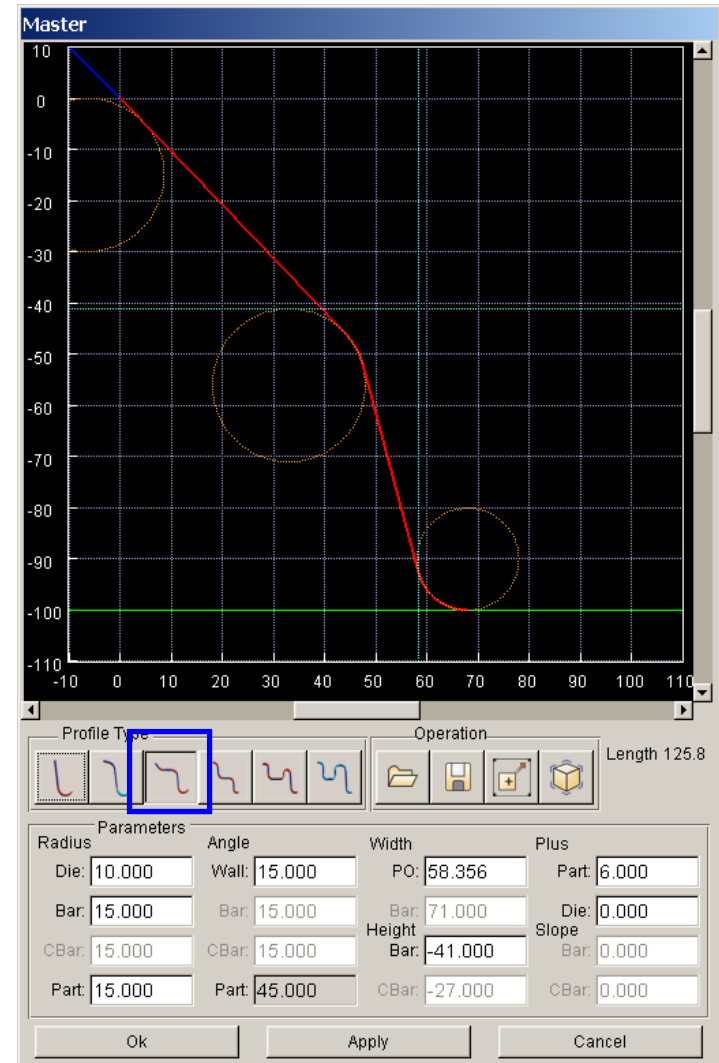
(b)

Figure 6.30

Tutorial VI

Create addendum segment continue ...

73. Click **New** (Master Profile) to insert master profile for sixth addendum
74. Select Profile Type, **#3** (Figure 6.31)
75. Key in **Die**, **Bar**, and **Part** radii
76. Key in **Part Plus**
77. Move the dashed blue lines to adjust “Width” and “Height”
78. Click **Apply**
79. Click **Ok** to dismiss Master Profile dialog window
80. Click **Assign** (Addendum)
81. Select type, **Outer**
82. Toggle on “By Segment”
83. Click **Select Region**
84. Pick two nodes on boundary to define region (Figure 6.30b)
85. Click **Apply**
86. Click **Close**



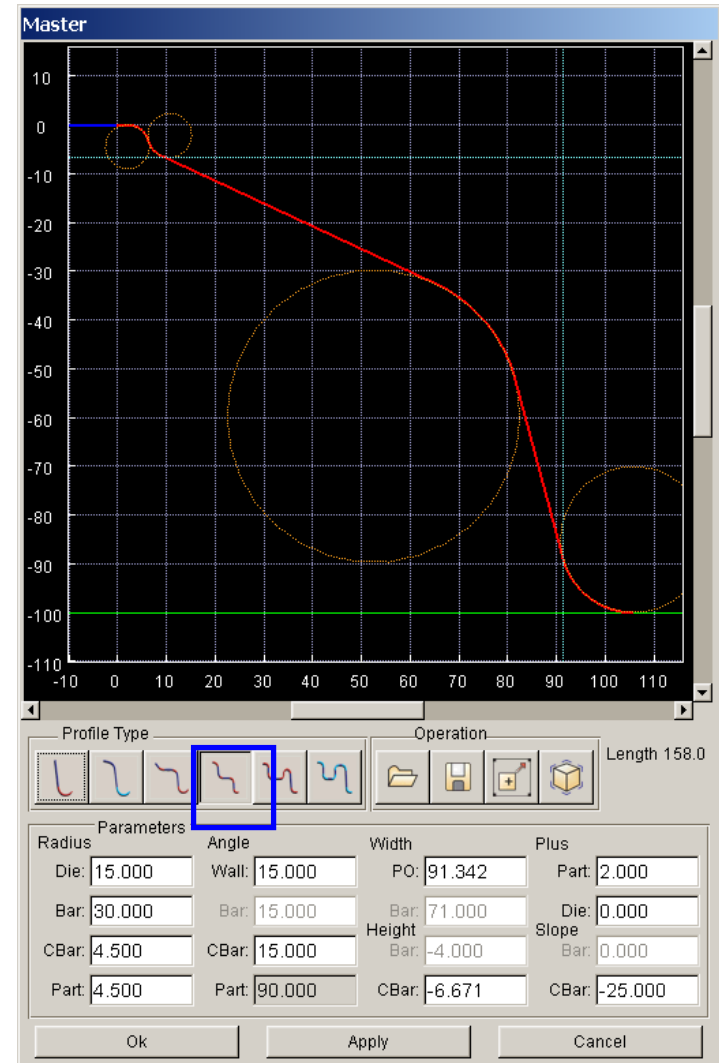
6th master profile

Figure 6.31

Tutorial VI

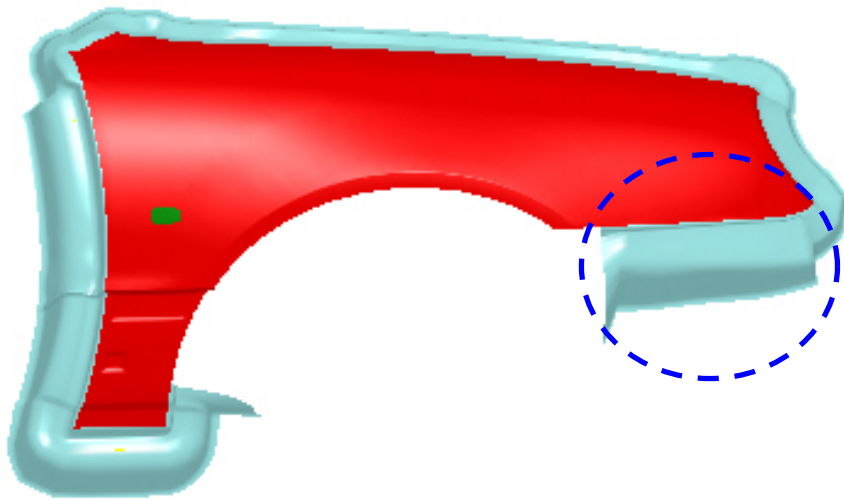
Create addendum segment continue ...

79. Click **New** (Master Profile) to insert master profile for seventh addendum
80. Select Profile Type, **#4** (Figure 6.32)
81. Key in **Die**, **Bar**, **CBar** and **Part** radii
82. Key in **CBar** width
83. Move the dashed blue lines to adjust “Width” and “Height”
84. Click **Apply**
85. Click **Ok** to dismiss Master Profile dialog window
86. Click **Assign** (Addendum)
87. Select type, **Outer**
88. Toggle on “By Segment”
89. Click **Select Region**
90. Pick two nodes on boundary to define region (Figure 6.33)
91. Click **Apply**
92. Click **Close**



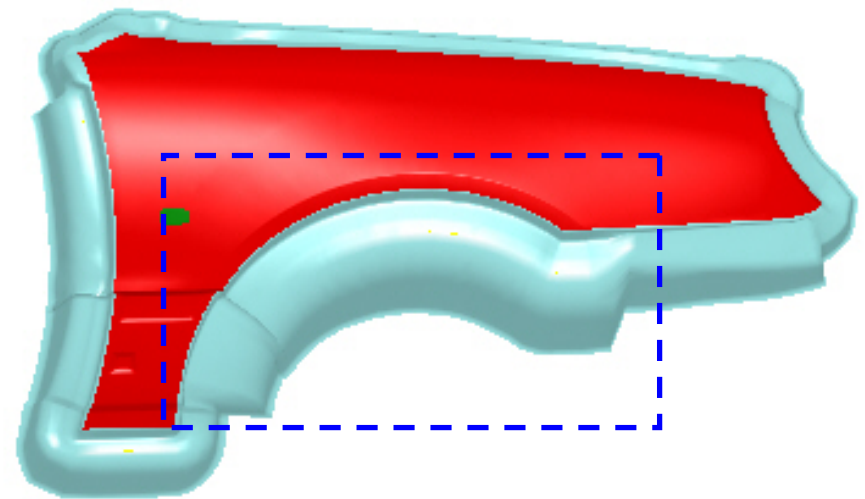
7th master profile

Figure 6.32



7th addendum segment

(a)



8th addendum segment

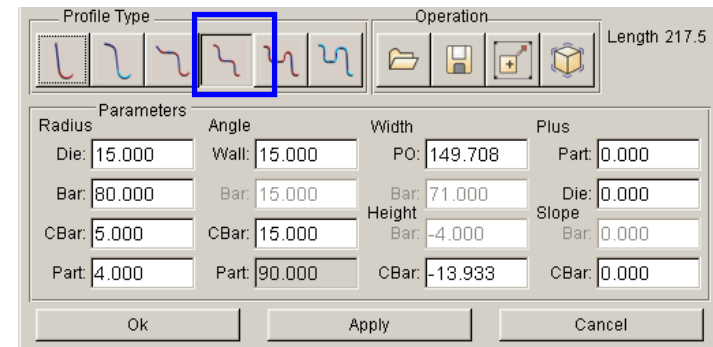
(b)

Figure 6.33

Tutorial VI

Create addendum segment continue ...

93. Click **New** (Master Profile) to insert master profile for eighth addendum
94. Select Profile Type, **#4** (Figure 6.34)
95. Key in **Die**, **Bar**, **CBar**, and **Part** radii
96. Key in **CBar** width
97. Move the dashed blue lines to adjust “**Width**” and “**Height**”
98. Click **Apply**
99. Click **Ok** to dismiss Master Profile dialog window
100. Click **Assign** (Addendum)
101. Select type, **Outer**
102. Toggle on “**By Segment**”
103. Click **Select Region**
104. Pick two nodes on boundary to define region (Figure 6.33b)
105. Click **Apply**
106. Click **Close**
107. Click **Close** to dismiss Addendum Generation dialog window



8th master profile

Figure 6.34

xii. Merge POP Line

- a) Click on *DFE*
- b) Select *Preparation*
- c) Click **IMPORT**
- d) Pick **POP_Line.igs**
- e) Click **Ok**
- f) Click **Exit** to dismiss DFE Preparation dialog window
- g) Click on *DFE*
- h) Select *Addendum*
- i) Click **Merge** (Addendum)
- j) Toggle on “POP Line”
- k) Click **Apply**
- l) Select profile group
- m) Select **New POP Line** (as shown in Figure 6.35a)
- n) Repeat steps (k) to (m) until the POP line for remaining profile group are merged
- o) Click **Close** to update addendum mesh
- p) See Figure 6.35b

Tutorial VI

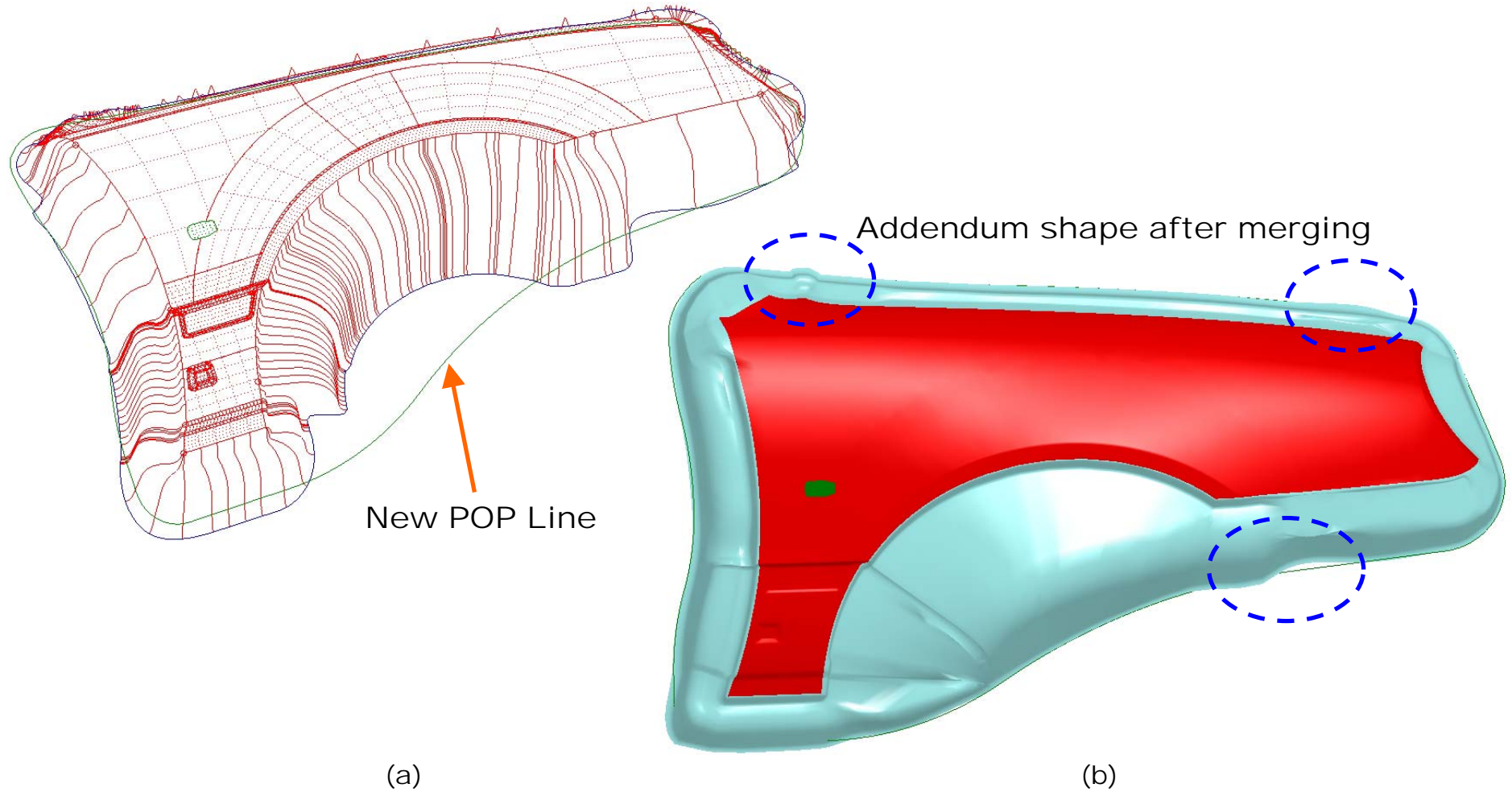
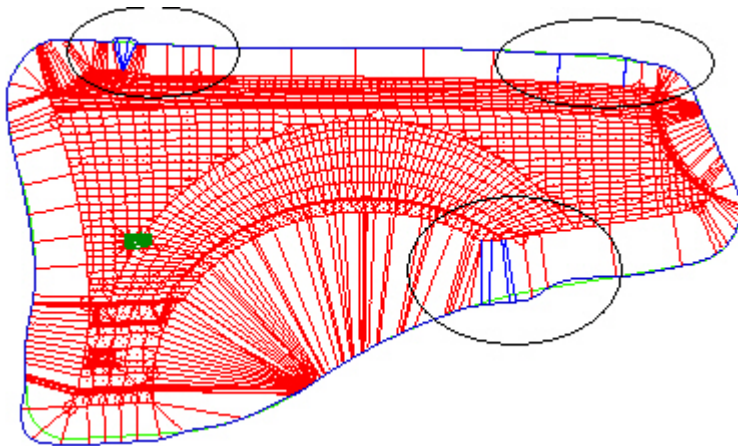


Figure 6.35

xiii. Delete Profile

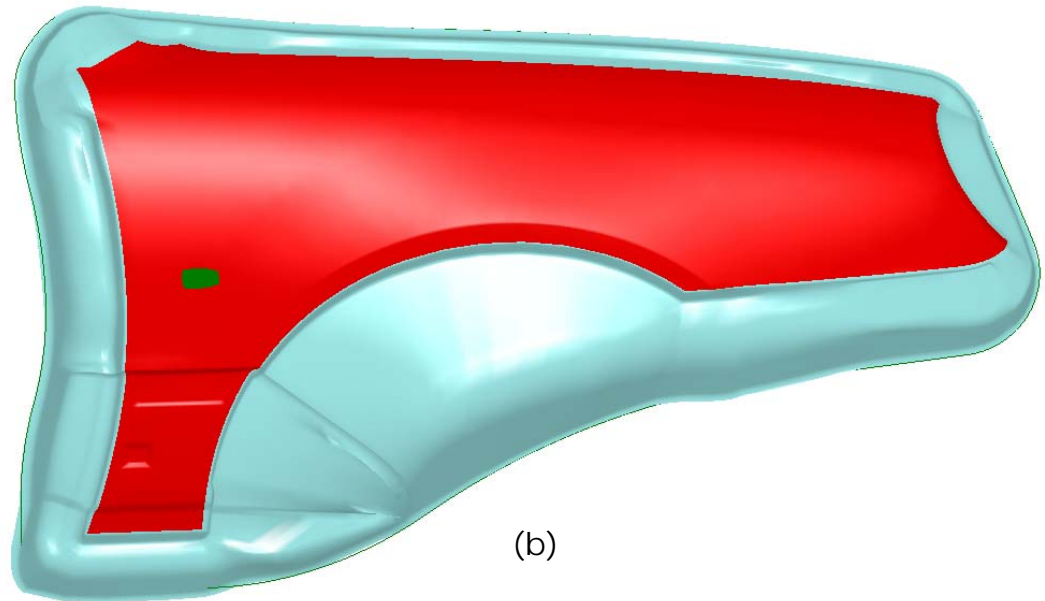
- a) Click **Delete** (Profile)
- b) Select profiles (See Figure 6.36a)
- c) Click **Ok** or **MMB** to confirm deletion
- d) Repeat steps (a) to (c) to delete all inferior profiles
- e) See Figure 6.36b

Select profiles for deleting



(a)

Addendum shape after deleting inferior profiles




(b)

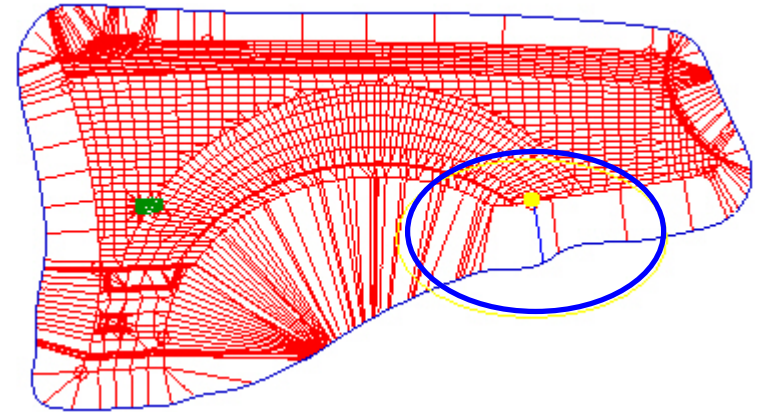
Figure 6.36

xiv. Modify profile

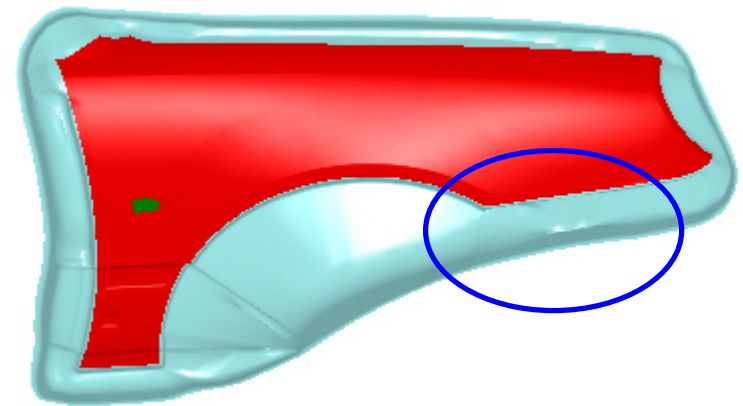
- Click **Modify** (Profile)
- Select one profile (See Figure 6.37a)
- Click **MMB** to open the Profile dialog window
- Edit profile parameters
- Click **Apply**
- Click **Ok** to exit Profile dialog window
- See Figure 6.37b

xv. Create addendum surface

- Click **Create Addendum Surface**
- Click **Close** to dismiss Addendum Generation dialog window
- Click on  to save the database



(a)




(b)

Figure 6.37

Note:

If you want to edit a group of profiles, select the start profile and end profile, then select profiles within this region, click OK to open the profile dialog window

xvi. Binder trimming

- a) Click on **DFE**
- b) Select **Modification**
- c) Select **BINDER TRIM**
- d) Select boundary type, **Outer**
- e) Toggle off “**Surface**”
- f) Click **Select** to select trimline (Figure 6.38a)
- g) Click **Apply**
- h) Click **Yes** to accept the displayed line for binder trimming
- i) Click **Close** to dismiss Complete Binder dialog window
- j) Turn off all parts and turn on **C_BINDER**
- k) Click **Exit** to dismiss DFE MODIFICATION dialog window
- l) Click on  to save the database
- m) See Figure 6.38b

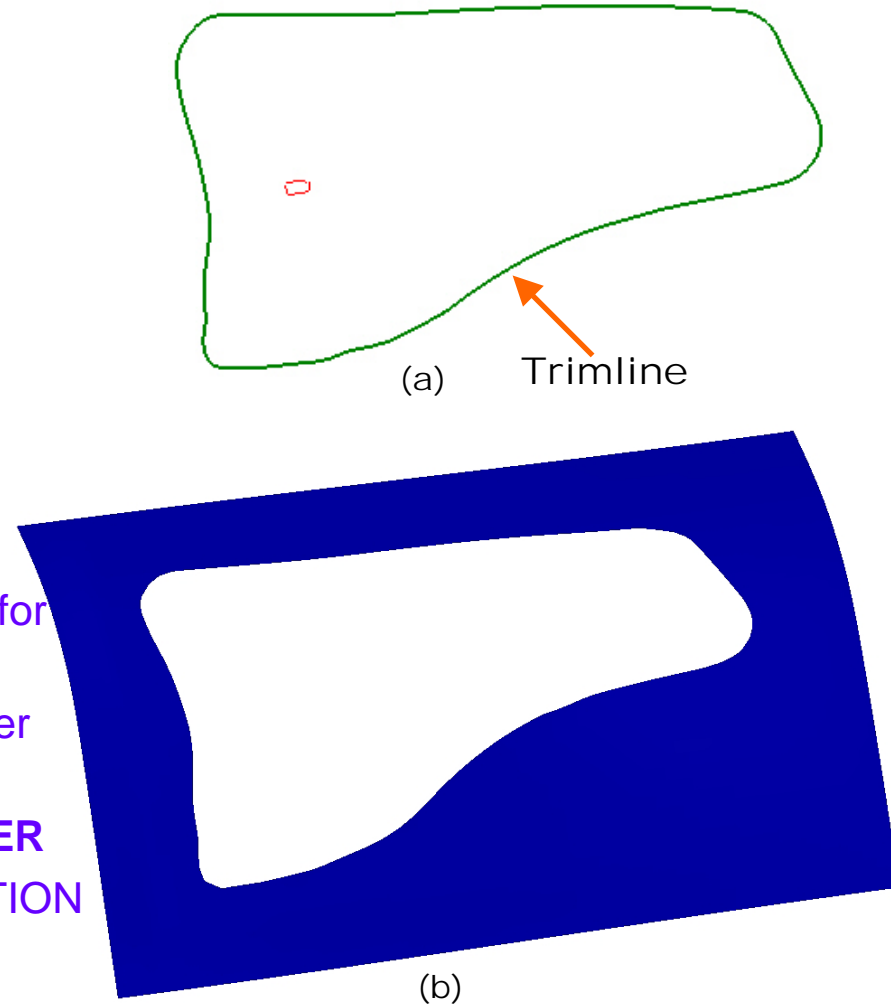


Figure 6.38

Thank You !!!