Siemens NX 8
Design Fundamentals

Jaecheol Koh
ONSIA Inc.

ONSIA

Siemens NX 8
Design Fundamentals
A Step by Step Guide

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Preface

This textbook explains how to create solid models, assemblies and drawings using Siemens NX 8.0. NX is a three dimensional CAD/CAM/CAE software developed by Siemens PLM Software Inc., Germany. This textbook is based on NX 8.0. Users of earlier releases can use this book with minor modifications. We provide files for exercises via our website. All files are in NX 6.0 so readers can open the files using NX 6.0 and later releases.

It is assumed that readers of this textbook have no prior experience in using Siemens NX for modeling 3D parts. This textbook is suitable for anyone interested in learning 3D modeling using Siemens NX.

Each chapter deals with the major functions of creating 3D features using simple examples and step by step, self-paced exercises. Additional drawings of 3D parts are provided at the end of each chapter for further self exercises. The final exercises are expected to be completed by readers who have fully understood the content and completed the exercises in each chapter.

Topics covered in this textbook

- Chapter 1: Basic components of Siemens NX 8.0, options and mouse operations.
- Chapter 2: Basic step by step modeling process of NX 8.0.
- Chapter 3 and 4: Creating sketches and sketch based features.
- Chapter 5: Usage of datums to create complex 3D geometry.
- Chapter 6: Additional modeling commands such as fillet, chamfer, draft and shell.
- Chapter 7: Modification of 3D parts to take advantage of parametric modeling concepts.
- Chapter 8: Copying features, modeling objects and bodies.
- Chapter 9: Additional modeling commands such as trim body, tube, sweep along guide, emboss and various commands in synchronous modeling.
- Chapter 10: Advanced sketch commands.
- Chapter 11: Measuring and verifying 3D geometries.
- Chapter 12 and 13: Constructing assembly structures and creating or modifying 3D parts in the context of assembly.
- Chapter 14 and 15: Creating drawings for parts or assemblies.

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Contents

Chapter 1 Starting NX

1.1 Introducing NX 2
1.2 Versions of NX 3
1.3 Executing NX 4
1.4 User Interface of NX 5
1.5 Roles 10
1.6 Mouse Operations 10
1.7 View Popup Menu 18
1.8 Customer Defaults 24
1.9 Tolerance 26

Chapter 2 Modeling Process with NX

2.1 Terms and Concepts 30
2.1.1 Three Dimensional Modeling 30
2.1.2 Feature Based Modeling 30
2.1.3 History Based Modeling 31
2.2 Introduction to NX 8 Modeling Process 33
2.2.1 Creating a Part File 33
2.2.2 Taking Out the Sketch in the Task Environment Icon 34
2.2.3 Creating the First Sketch 36
2.2.4 Extruding the Sketch 45
2.2.5 Creating the Second Sketch 47
2.2.6 Extruding the Sketch 49
2.2.7 Rounding Edges 50
2.2.8 Hollowing Out the Solid Body 53
2.2.9 Subtracting with a Cylinder 55
2.3 Summary of the Modeling Process 57

Chapter 3 Sketch

3.1 Introduction 60
3.2 Creating a Sketch 61
Exercise 01 61
3.3 Deleting a Sketch Feature 63
3.4 Sketch Procedure 63
3.4.1 Defining the Sketch Plane 63
3.4.2 Creating Sketch Curves 64
3.4.3 Constraint 64
3.4.4 Finish the Sketch 64
Exercise 02 65
3.5 Profile 67
Exercise 03 68
3.6 Snap Point Option 72
3.7 Constraining Sketch Curves 73
3.8 Status of Constraint 76
3.9 Evaluating Sketch Status by Dragging 78
Exercise 04 79
3.10 Deleting and Modifying Sketch Objects 84
3.10.1 Deleting Sketch Feature or Objects 85
Exercise 05 85
Exercise 06 88
Exercise 07 91
3.11 Other Sketch Commands 92
3.11.1 Quick Trim 92
3.11.2 Fillet 93
3.11.3 Mirror Curve 94
Exercise 08 95
Exercise 09 97
Exercise 10 98
Exercise 11 99
Exercise 12 101
Exercise 13 102

3.12 Reference Dimension and Curve 105
Exercise 14 107
3.13 Direct Sketch 109
Exercise 15 115
Exercise 16 116
Exercise 17 117
Exercise 18 119

Chapter 4 Creating 3D Geometry

4.1 Introduction to Extruding 122
4.2 Understanding a Section 123
4.2.1 Condition of a Section 123
4.2.2 Inconsistent Sections 124
4.3 Selection Intent 126
4.3.1 Curve Rule 126
4.3.2 Stop at Intersection 127
4.3.3 Follow Fillet 127
4.3.4 Chain within Feature 127
Exercise 01 128
4.4 Boolean Option 134
4.4.1 Unite 135
4.4.2 Subtract 135
4.4.3 Intersect 135
4.4.4 None 136
4.4.5 Boolean Operation Between Bodies 136
Exercise 02 138
4.5 Sketch Coordinate System 142
4.6 Direction Option of Extrude 143
4.7 Limit Option 144
4.7.1 Symmetric Value 144
4.7.2 Until Next 145
4.7.3 Until Selected 146

4.7.4 Until Extended 147
4.7.5 Through All 148
4.8 Other Options in Extrude Command 149
4.8.1 Draft 149
4.8.2 Offset 149
Exercise 03 150
4.9 Editing Object Display 151
4.10 Revolve 152
4.10.1 Section and Axis of Revolve 153
4.11 Creating Holes 156
4.11.1 General Type Holes 157
4.11.2 Threaded Type Holes 158
Exercise 04 159
Exercise 05 164
4.12 Creating a Boss 165
Exercise 06 165
Exercise 07 170
Exercise 08 171
Exercise 09 172
Exercise 10 173
Exercise 11 175
Exercise 12 177

Chapter 5 Datums

5.1 Datums 180
5.2 Datum Plane 181
5.2.1 Usages of a Datum Plane 182
5.2.2 Types of Datum Plane 184
Exercise 01 184
Exercise 02 187
Exercise 03 189
Exercise 04 194

Exercise 05 197
Exercise 06 200
5.3 Point 202
5.3.1 Output Coordinates 202
5.3.2 Offset 203
5.3.3 Associative Option 203
5.4 Datum Axis 204
5.4.1 Characteristics of a Datum Axis 204
5.4.2 Usages of Datum Axis 205
5.4.3 Types of Datum Axis 206
Exercise 07 207
Exercise 08 211
5.5 Datum Coordinate System 214
Exercise 09 216
Exercise 10 217
Exercise 11 219
Exercise 12 221
Exercise 13 223

Chapter 6 Additional Modeling Commands - Part I

6.1 Detail Modeling 226
6.2 Edge Blend 227
6.2.1 Types of Edge Blend 228
Exercise 01 229
Exercise 02 231
6.2.2 Shape Option 233
Exercise 03 234
6.2.3 Guideline for Applying Edge Blend 239
Exercise 04 240
Exercise 05 241
Exercise 06 243
Exercise 07 244

Exercise 08 245
6.3 Chamfer 248
6.3.1 Procedure 248
6.3.2 Cross Section Option 249
6.3.3 Offset Method 251
6.4 Draft 254
6.4.1 Types of Draft 256
Exercise 09 257
Exercise 10 260
Exercise 11 263
Exercise 12 265
6.5 Shell 266
6.5.1 Reverse Direction 267
6.5.2 Alternate Thickness 268
Exercise 13 270
Exercise 14 271
Exercise 15 272
Exercise 16 273
Exercise 17 274
Exercise 18 276

Chapter 7 Parametric Modification

7.1 Understanding Parametric Modification 280
7.1.1 Parent - Children Relationship of Features 280
7.1.2 Deleting a Feature 282
7.2 Modifying a Sketch 282
Exercise 01 283
7.2.1 Changing the Sketch Plane 287
7.3 Inserting a Feature (Make Current Feature) 288
Exercise 02 289
7.4 Modifying Feature Definition 292
7.4.1 Reselecting Target Objects 293

Exercise 03 294
Exercise 04 297
7.5 Reordering a Feature 303
Exercise 05 304
Exercise 06 308
Exercise 07 309
Exercise 08 312

Chapter 8 Copy of Objects and Features

8.1 Introduction 316
8.2 Classifying Copy Commands 316
8.2.1 Source of Copy 317
8.2.2 Method of Copy 317
8.2.3 Summary 319
8.3 Pattern Feature 320
8.3.1 Linear Type 320
Exercise 01 322
Exercise 02 325
8.3.2 Cautions in Using the Pattern Feature Command 329
Exercise 03 330
8.3.3 Circular Type 332
Exercise 04 333
Exercise 05 338
8.4 Mirror Feature 339
8.5 Mirror Body 339
Exercise 06 340
8.6 Pattern Face 344
Exercise 07 344
8.7 Instance Geometry 346
Exercise 08 347
8.8 Copy and Paste of Features 348
Exercise 09 349

Exercise 10 352
Exercise 11 356
Exercise 12 357
Exercise 13 358

Chapter 9 Additional Modeling Commands - Part II

9.1 Trim Body 360
9.1.1 Procedure 360
Exercise 01 362
Exercise 02 364
9.2 Tube 366
9.2.1 Procedure 366
9.2.2 Output Option 367
9.3 Sweep along Guide 368
9.3.1 Procedure 368
9.4 Emboss 370
Exercise 03 370
9.5 Synchronous Modeling 373
9.5.1 Move Face 373
Exercise 04 373
9.5.2 Resize Blend 375
Exercise 05 375
9.5.3 Delete Face 376
Exercise 06 376
9.5.4 Copy Face 378
Exercise 07 378
9.5.5 Make Coplanar 381
Exercise 08 381
9.5.6 Linear Dimension 383
Exercise 09 383
9.5.7 Radial Dimension 387
Exercise 10 387

Exercise 11 389
Exercise 12 390

Chapter 10 Advanced Sketch

10.1 Intersection Point 392
10.1.1 Executing the Intersection Point Command 392
10.1.2 Intersection Point Dialog Box 393
Exercise 01 394
10.2 Intersection Curve 396
10.2.1 Executing the Intersection Curve Command 396
10.2.2 Intersection Curve Dialog Box 397
Exercise 02 397
10.3 Project Curve 399
10.3.1 Executing the Project Curve Command 399
10.3.2 Project Curve Dialog Box 400
Exercise 03 400
Exercise 04 403
10.4 Trimming Recipe Curve 406
10.4.1 Executing the Trim Recipe Curve Command 407
10.4.2 Trim Recipe Curve Dialog Box 407
Exercise 05 408
10.5 Offset Curve 410
10.5.1 Executing the Offset Curve Command 410
10.5.2 Offset Curve Dialog Box 411
Exercise 06 411
Exercise 07 414
Exercise 08 415

Chapter 11 Measurements

11.1 Measure Distance 418
11.1.1 Measure Distance Dialog Box 418

11.1.2 Distance 419
Exercise 01 419
11.1.3 Projected Distance 422
Exercise 02 422
11.1.4 Length Type 425
11.1.5 Radius Type 426
11.2 Measure Angle 427
11.2.1 Measure Angle Dialog Box 427
Exercise 03 427
11.3 Measure Bodies 430
11.3.1 Executing Measure Bodies Command 430
11.3.2 Measure Bodies Dialog Box 430
Exercise 04 431
11.3.3 Detailed Information 433
Exercise 05 434

Chapter 12 Assembly Design I (Bottom-Up Assembly)

12.1 Introduction 440
12.2 Terms and Definitions 440
12.2.1 Component 440
12.2.2 Master Part 441
12.2.3 Sub-assembly 441
12.2.4 BOM (Bill of Material) 441
12.2.5 Bottom-up Assembly Design 441
12.2.6 Top-Down Assembly Design 441
12.3 Key Functions in Assemblies 442
12.4 Constructing an Assembly 442
12.4.1 Creating Assembly File 443
Exercise 01 443
12.4.2 Assembly Option 445
12.4.3 Adding Components 446
Exercise 02 446

12.4.4 Saving Assembly File 449
Exercise 03 450
12.4.5 Closing Files 453
12.4.6 Opening Files 454
Exercise 04 456
12.4.7 Using the Assembly Navigator 459
12.4.8 Moving and Rotating Component 460
Exercise 05 461
Exercise 06 462
12.4.9 Copy of Component 463
12.5 Assembly Constraints 464
12.5.1 Fix 465
12.5.2 Touch/Align 466
Exercise 07 469
12.5.3 Center 472
Exercise 08 474
12.5.4 Concentric 475
12.5.5 Other Constraints 475
12.5.6 Verifying Constraint Status 476
12.5.7 Showing and Hiding Constraints 477
12.5.8 Suppressing Constraints 478
12.6 Reference Set 479
Exercise 09 481
Exercise 10 485

Chapter 13 Assembly Design II (Top-Down Assembly)

13.1 Context Control 488
13.1.1 Closing Component 488
13.1.2 Opening Component 489
13.1.3 Make Work Part 490
13.1.4 Make Displayed Part 492
Exercise 01 493

13.2 Interference Check 497
13.2.1 Types of Interference 497
Exercise 02 499
13.3 Referencing Component Geometry 505
13.3.1 Interpart Link 505
13.3.2 Selection Scope 506
Exercise 03 507
Exercise 04 510
13.4 Creating a New Component 515
Exercise 05 516
13.5 Disassembling an Assembly 520
Exercise 06 520
13.6 Additional Assemblies Commands 524
13.6.1 Display of Components 524
13.6.2 Sectioning 525
Exercise 07 525
13.6.3 Measuring Mass 529
Exercise 08 529
Exercise 09 532

Chapter 14 Creating Drawing Views

14.1 Introduction 536
14.2 Terms and Definitions 537
14.2.1 Drawing View 537
14.2.2 Title Block 537
14.2.3 Drawing Sheet 537
14.3 Drawing File 538
14.3.1 Creating a Drawing File 538
14.3.2 Understanding the Drawing Screen 542
14.3.3 Saving the Drawing File 544
14.4 Drawing Sheet 544
14.4.1 Creating a Drawing Sheet 544

14.4.2 Setting a Drawing Sheet 545
14.5 Drawing View 548
14.5.1 Base View 548
14.5.2 Projected View 550
Exercise 01 550
14.5.3 View Style 557
14.5.4 Section View 559
Exercise 02 562
14.5.5 Detail View 567
Exercise 03 568
14.5.6 Break-out Section View 571
14.5.7 Break View 572
Exercise 04 572
14.6 View Dependent Edit 576
14.7 Resizing View Boundary 577
14.8 Modifying the Master Part and Component Orientation 578
Exercise 05 578

Chapter 15 Dimension, Annotation and Assembly Drawing

15.1 General Procedure of Creating Drawings 584
15.2 Creating Dimensions 584
15.3 Modifying the Dimension Style 589
15.3.1 Edit Dimension Option Bar 589
15.3.2 MB3 on Highlighted Dimension 590
15.3.3 MB3 on the Dimension 590
15.4 Aligning Dimensions 591
Exercise 01 592
15.5 Notes 595
15.5.1 Modifying the Note 597
15.5.2 Multiple Terminating Objects 598
15.6 Center Lines 598
15.6.1 Center Mark 599

15.6.2 Bolt Circle Centerline 600
15.6.3 2D Centerline 600
15.6.4 3D Centerline 601
15.7 Using the Inherit Option 602
Exercise 02 603
Exercise 03 606
15.8 Assembly Drawing 609
15.8.1 Excluding Components in a Drawing View 610
Exercise 04 611
15.8.2 Break-out Section View for an Assembly Drawing View 615
Exercise 05 615
15.8.3 Disassembled Drawing View 617
Exercise 06 618

chapter

6 Additional Modeling Commands - Part I

After completing this chapter you will understand

- the types and procedure of **Edge Blend**.
- how to create **Chamfer** on an edge.
- designer's requirements of **Draft**.
- various types and options of **Draft**.
- how to apply wall thickness by using the **Shell** command.

6.1 Detail Modeling

Recall the general modeling process introduced in Section 2.3.

1. Create a sketch.
   ► Defi ne the sketch plane.
   ► Create the sketch curves and defi ne their shape with constraints.

2. Create 3D geometry.
   ► Create features using the **Extrude** or **Revolve** command to add or remove volumes.

3. Detail Modeling
   ► Complete the model by applying commands such as Edge Blend and Shell that modify edges or faces

Sample Chapter

In this chapter, we will learn commands that are used in the third step.

There are four commands that can be classifi ed in detail modeling: **Edge Blend**, **Chamfer**, **Draft** and **Shell**. Detail modeling commands do not require a sketch. They can be applied on edges or faces that have already been created.

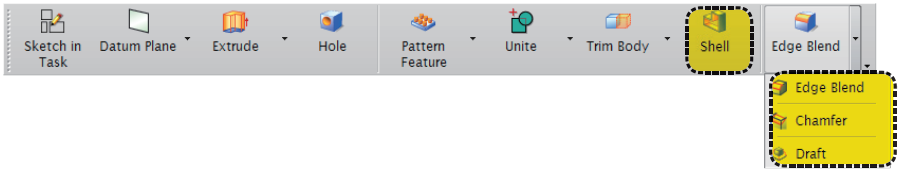


Fig 6-1 Icons for Detail Modeling

6.2 Edge Blend

Sharp edges can be rounded with the **Edge Blend** command which is generally called a fillet.

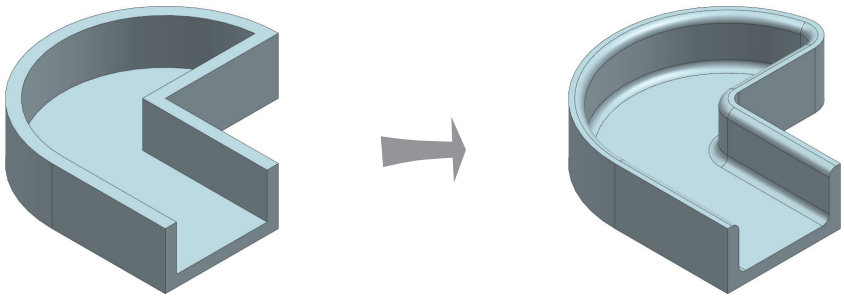


Fig 6-2 Before Edge Blend

Fig 6-3 After Edge Blend

Edge fillets are applied to smoothen sharp edges. There are two types of sharp edges. Fig6-4 shows concave edges Ⓐ and convex edges Ⓑ .

Sample Chapter

When a part has been manufactured, convex edges can damage the parts, resulting in deterioration of product quality. They can even cause injury to people who deliver or handle the parts.

When a load is applied to a part, the stress will concentrate at the concave edges and a fracture may initiate from these edges. Using the **Edge Blend** command, you can create fillets on the concave or convex edges in the 3D model. Some types of fillets are created inevitably during the manufacturing process and some are required to improve the mechanical performance of the part.

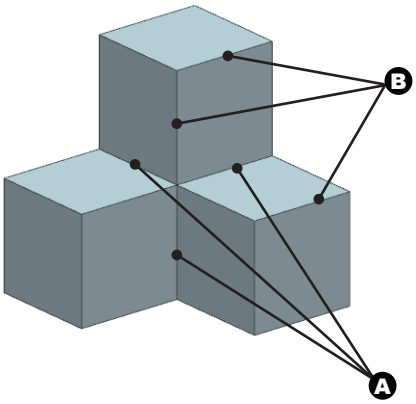
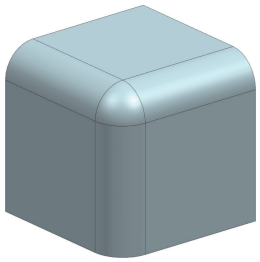


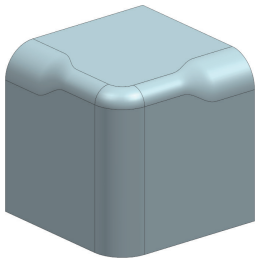
Fig 6-4 Types of Edges

6.2.1 Types of Edge Blend

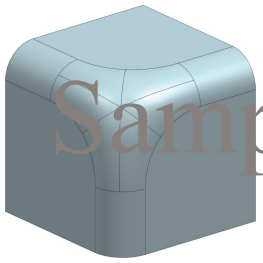
In NX 8, there are four types of edge blends available as shown in Fig 6-5.



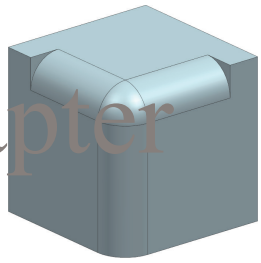
<General Blend>



<Variable Radius Blend>



<Setback Blend>



<Limit Blend>

Sample Chapter

Fig 6-5 Types of Edge Blends

A setback blend can be applied on vertices where three or more edges meet. You can cre-atea smoother blend on vertices.

A limit blend is applied on edges where you cannot create a complete fillet on the edge due to the complexity of the geometry. An edge blend is limited to a portion of the edge by specifying the distance from one end of the selected edge.

You can also apply blends on an edge with various radiuses at the specified points.

This exercise explains how to create general edge blend.

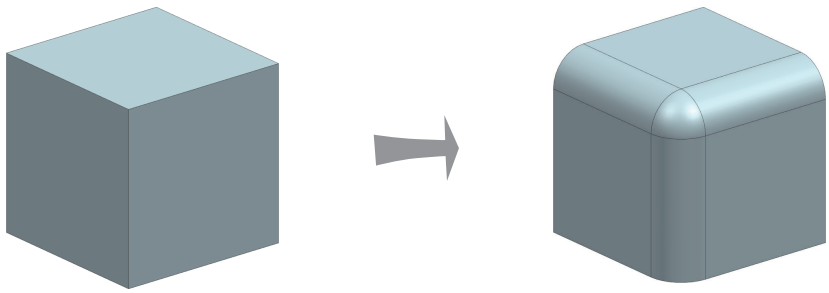


Fig 6-6 Before and After Edge Blend

Sample Chapter

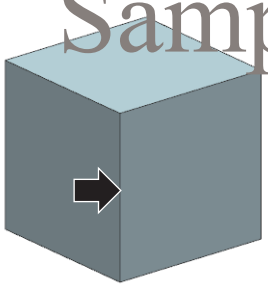


Fig 6-7 A Block

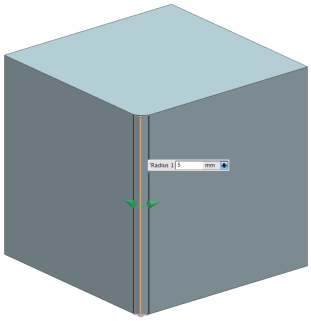


Fig 6-8 Preview of Edge Blend

1. Create a new part file and create a block as shown in Fig 6-7.
2. Click the **Edge Blend** icon in the **Feature** toolbar.
3. Reset the dialog box.
4. Select the vertical edge designated by the arrow in Fig 6-7. You can see the preview of the 5 mm radius fillet as shown in Fig 6-8.
5. Delete the **Radius 1** value in the **Edge Blend** dialog box shown in Fig 6-9 and press the **Enter** key. You can see the preview of Radius 1 = 20 fillet in the graphics window. Press the **Apply** button in the dialog box.

The sharp edge is rounded as shown in Fig 6-9.

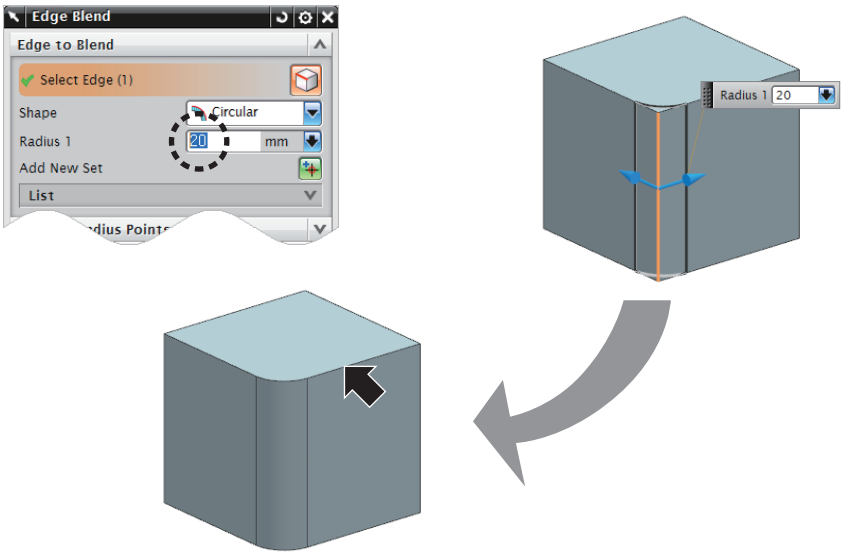


Fig 6-9 Creating R20 Edge Blend

Sample Chapter

6. Ensure that the **Radius 1** value is 20 and select the edge designated by the arrow in Fig 6-9.

All three edges are selected together as shown in Fig 6-10.

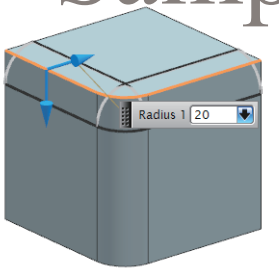


Fig 6-10 Preview of Edge Blend

7. Press **OK** in the dialog box. A 20mm radius edge blend is applied on the three tangent connected edges as shown in Fig 6-11.

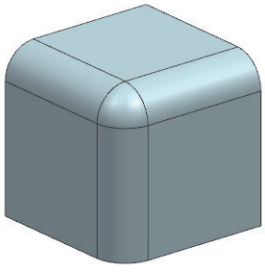


Fig 6-11 Edge Blend Created

8. Close without saving the file.

END of Exercise

Curve Rule

The Edge Blend is a command that can be applied on edges. Therefore, the Curve Rule is available at the selection step. The reason why the three edges are selected at the same time in Fig 6-10 is that the default curve rule for Edge Blend is Tangent Curves.

Fig 6-12 Curve Rule

Add New Set Exercise 02

You can define edge blends for several radiuses in a single **Edge Blend** feature. Let's learn how to add a new set of blend radiuses in the **Edge Blend** dialog box.

Sample Chapter

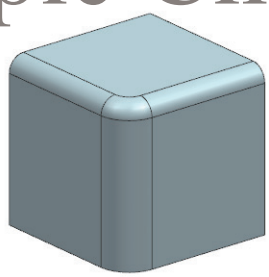


Fig 6-13 Edge Blend to Create

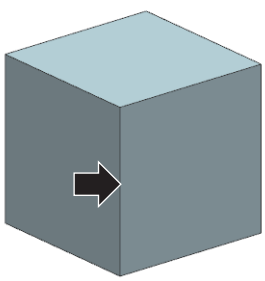


Fig 6-14 A Block

1. Create a new part file and create a block as shown in Fig 6-14.
2. Click the **Edge Blend** icon in the **Feature** toolbar.
3. Reset the dialog box.
4. Enter 20 in the **Radius 1** input box and press the **Enter** key.
5. Select the vertical edge designated by the arrow in Fig 6-14.

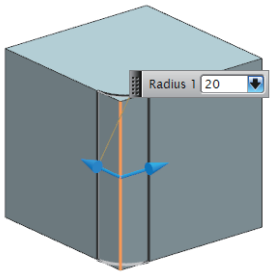


Fig 6-15 Preview of Edge Blend

A 20 mm radius edge blend is previewed as shown in Fig 6-15.

6. Expand the **List** area of the dialog box by clicking the title as shown in Fig 6-16.
7. Click the **Add New Set** icon as specifi ed by the arrow in Fig 6-16. The edge blend is defi ned in the **List** area.

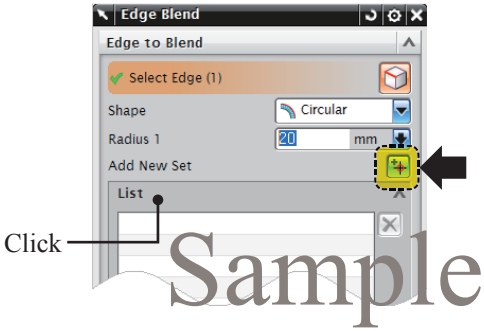


Fig 6-16 Add New Set Option

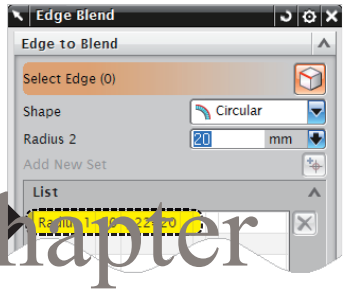


Fig 6-17 Edge Blend Defi ned

Sample Chapter

8. Enter 10 in the **Radius 2** input box and press the **Enter** key.
9. Select the two edges designated by Ⓐ in Fig 6-18.
10. Press **OK** in the dialog box. The edge blend is created as shown in Fig 6-13. Only one edge blend feature is recorded in the **Part Navigator** as shown in Fig 6-19.
11. Close without saving the file.

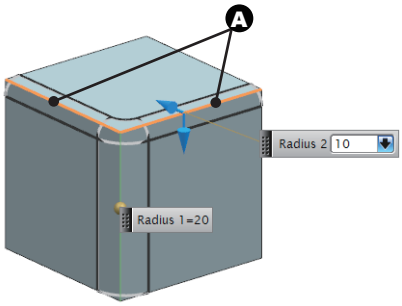


Fig 6-18 Edges to Select

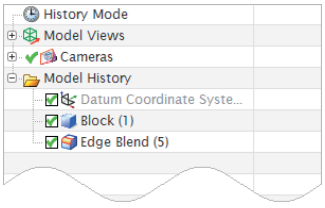


Fig 6-19 Part Navigator

END of Exercise

Quiz!

Why is the **Tangent Curves** curve rule not applied when selecting edges in Fig 6-18?

Answer: The edge blend of radius 20mm is not created yet but it is just a preview. Therefore, the two edges are not tangent connected.

6.2.2 Shape Option

The shape option defines the sectional shape of the blend surface. While the **Circular** type generates a constant curvature surface along the section line, the **Conic** type generates a variable curvature surface.

Sample Chapter

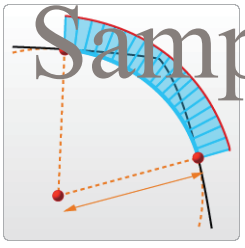


Fig 6-20 Curvature of Circular Type

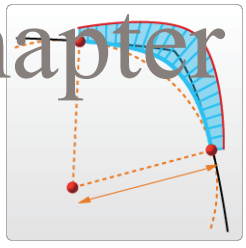


Fig 6-21 Curvature of Conic Type

If you choose the **Conic** type in the **Shape** option, other options are changed to define the variable curvature fillet.

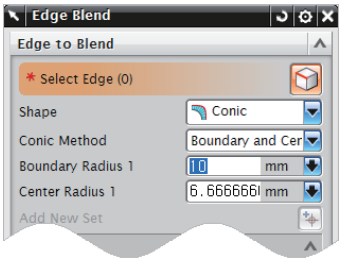


Fig 6-22 Options for Conic Blend

Exercise 03 Variable Radius Edge Blend

Let's learn the process of applying a variable radius edge blend.

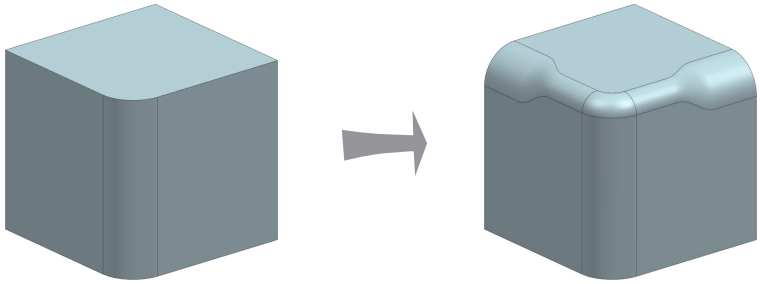


Fig 6-23 Before and After Variable Radius Edge Blend

Sample Chapter

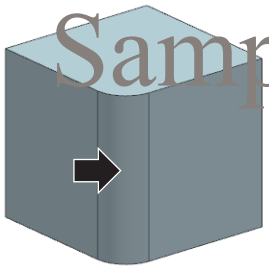


Fig 6-24 A Block

1. Create an arbitrarily named part file and create a block feature.
2. Apply an R20 edge blend as shown in Fig 6-24.
3. Click the **Edge Blend** icon again.
4. Select the edges to apply the blend by clicking the edge designated by the arrow in Fig 6-25.
5. Expand the option group by clicking the title of **Variable Radius Points** as shown in Fig 6-26.

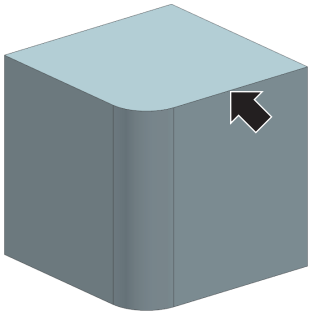


Fig 6-25 Edge to Select

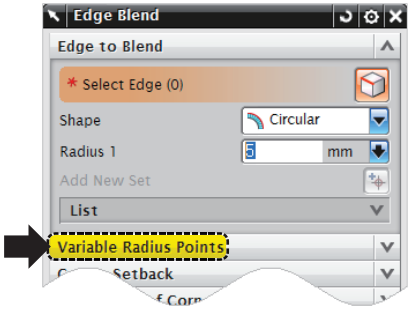


Fig 6-26 Variable Radius Points Option

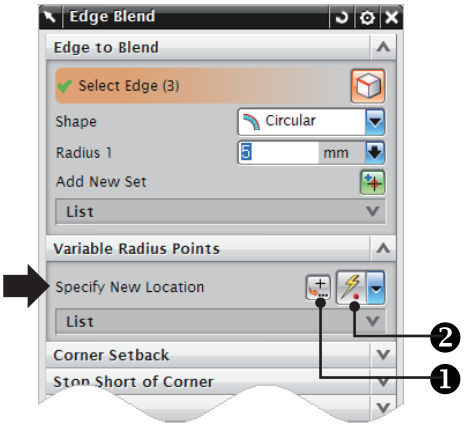


Fig 6-27 Specify New Location

6. Click the Specify **New Location** option as designated by the arrow in Fig 6-27.

7. Select the end point designated by the arrow in Fig 6-28. Be sure to click MB1 when the end point is snapped as shown in Fig 6-29. Any of the three edges that meet at the vertex may be highlighted.

Sample Chapter

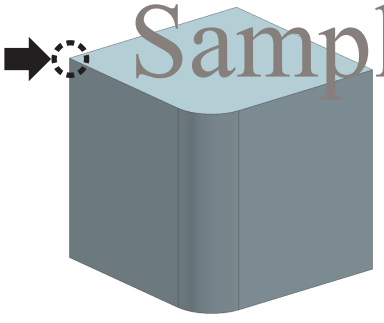


Fig 6-28 End Point of the Edge

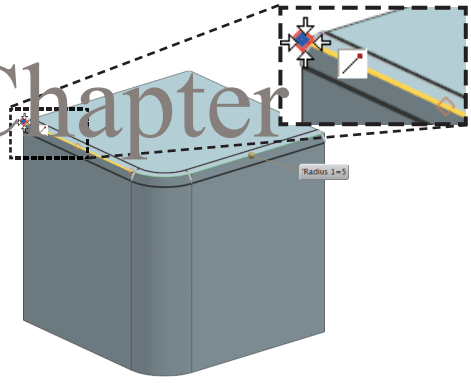


Fig 6-29 Snapped End Point

Caution!

Option buttons ❶ and ❷ specified in Fig 6-27 are the Point Constructor and Snap Point options, respectively. After clicking the title of the **Specify New Location** option, you can select points using the Snap Point option in the selection bar. The options ❶ and ❷ are used when you cannot select the desired points with the **Snap Point** option.

Fig 6-30 Snap Point Option

8. Delete the value in the **V Radius** input box shown in Fig 6-31 and type 20, then press the **Enter** key.

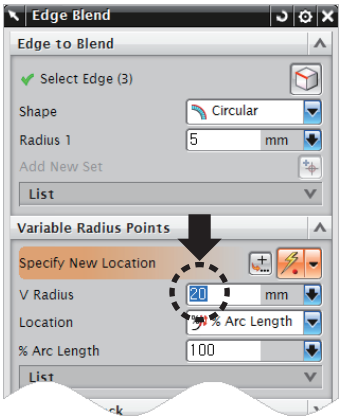


Fig 6-31 V Radius Value

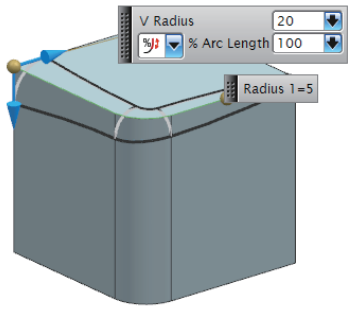


Fig 6-32 Preview of R20 Blend at the End Point

Sample Chapter

9. Ensure that the **Point on Curve** button in the **Snap Point** option is turned on as shown in Fig 6-33.

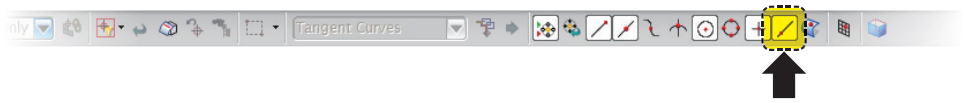


Fig 6-33 Point on Curve Option

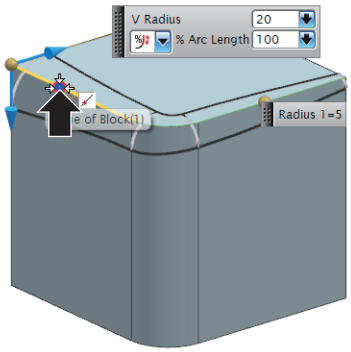


Fig 6-34 Specifying the Point Location

10. Select the point around the location specified in Fig 6-34. You may select a point around the middle because we will modify the % value.

11. Enter 65 in the **% Arc Length** input box designated by the arrow in Fig 6-35 and press the **Enter** key. The new location of V Radius = 20 mm point is previewed as in Fig 6-36.

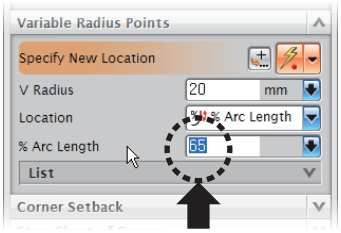


Fig 6-35 % Arc Length Value

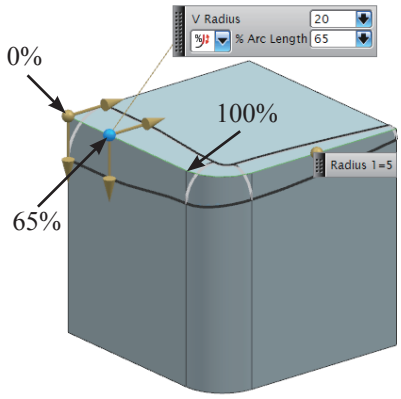


Fig 6-36 Location of % Arc Length

Sample Chapter

Caution!

The start and end of the **% Arc Length** is defined for each edge. Although three edges are selected for edge blend, the start and end of the **% Arc Length** is not defined as in Fig 6-37.

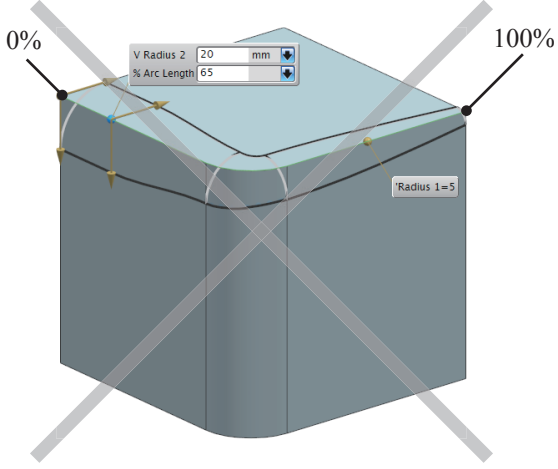
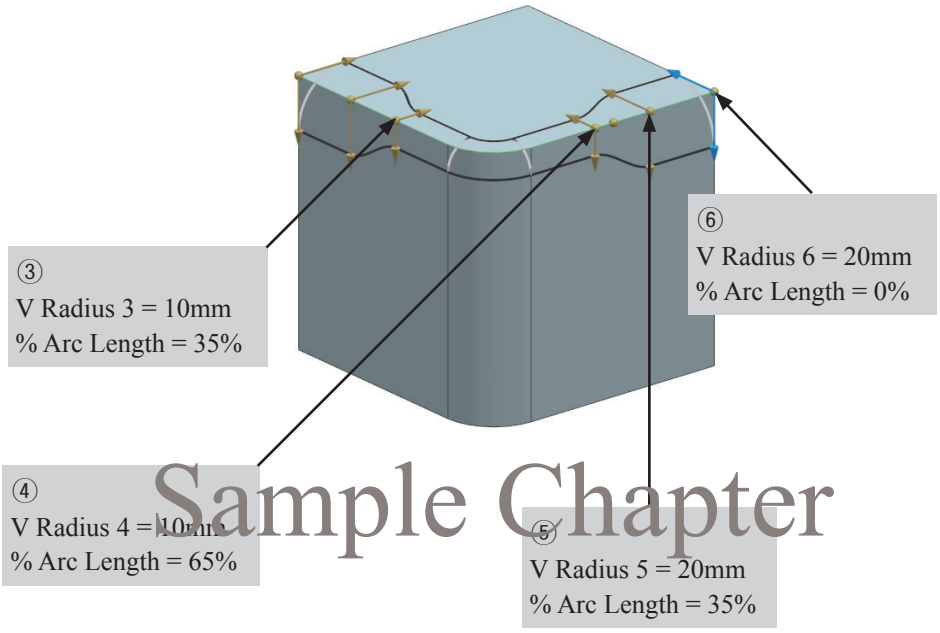


Fig 6-37 Wrong Understanding of % Arc Length

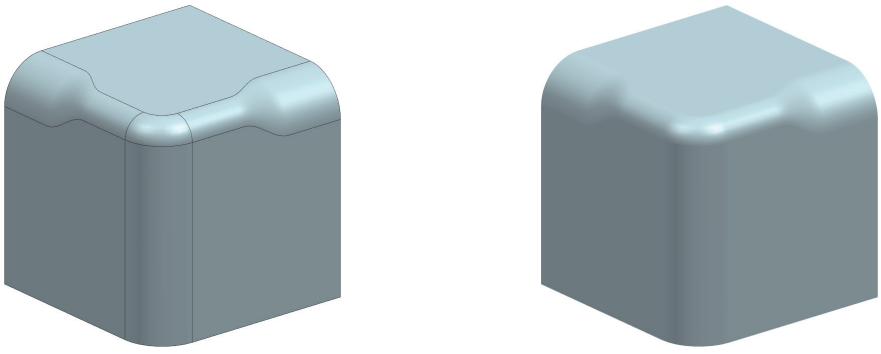
12. In the same manner as steps 9 to 11, define each radius for the four points specified in Fig 6-38. Note that you may have to enter different **% Arc Length** values for points 4 and 5 depending on the start point of the edge.



Sample Chapter

Fig 6-38 Values for Four Points

13. Press **OK** in the dialog box. Various radius edge blends are created as shown in Fig 6-39. Close without saving the file.



<Shaded with Edge> <Shaded>

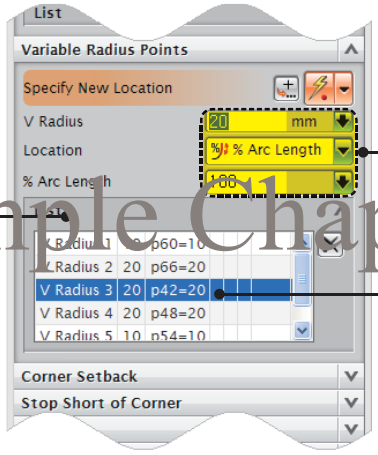
Fig 6-39 Variable Radius Edge Blend Created

END of Exercise

Modifying Variable Radius Edge Blends

You can modify the values in a variable radius edge blend according to the following procedure. Refer to the numbers in Fig 6-40 for each step number.

① Double click the edge blend feature in the **Part Navigator**.
② Click the **List** title in the **Variable Radius Points** option group in the **Edge Blend** dialog box.
③ Select the item to modify.
④ Modify the **V Radius** and **Location** value.



Sample Chapter

Fig 6-40 Modifying Variable Radius Edge Blend

6.2.3 Guideline for Applying Edge Blend

Quite often you will not be able to create a satisfactory edge blend for complex geometry. The following guidelines outline the steps to create edge blends successfully.

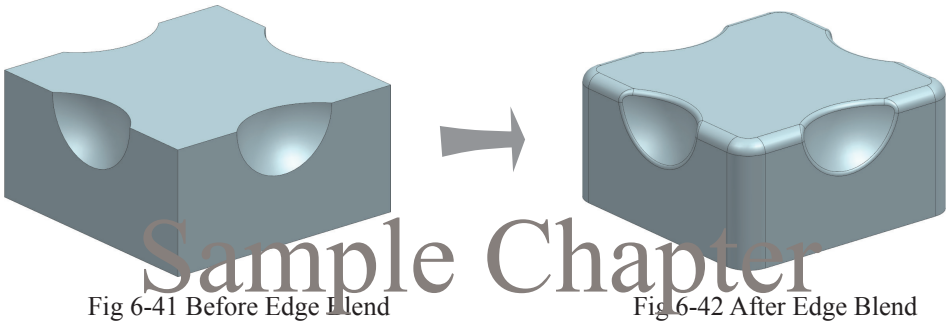
1. Apply the fillet for the larger radius first, and then proceed to the smaller ones.
2. Apply the fillet for the concentrated edges first by selecting the edges at the same time.
3. Apply fillets one by one, not as a single feature.
4. Apply the fillet for the separate edges first so that the edges to be selected later are tangent connected.

Exercise 04 Applying Edge Blend

ch06_ex04.prt

Open the file ch06_ex04.prt and apply edge blend on all edges except the bottom face as shown in Fig 6-42. The blend radiuses for each edge are specified in Fig 6-43 and Fig 6-44.

Note that the edge blends are not the variable radius blend. Try to apply the blends one by one, not as a single feature.



Sample Chapter

Fig 6-41 Before Edge Blend

Fig 6-42 After Edge Blend

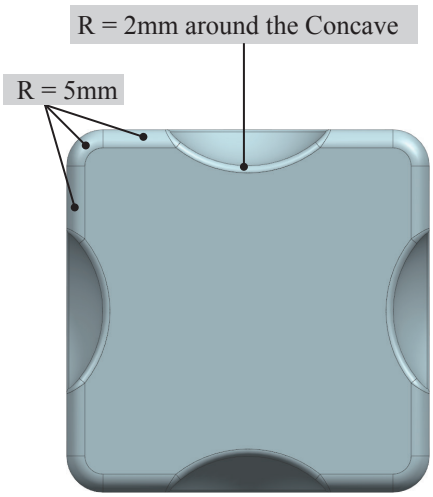


Fig 6-43 Top View

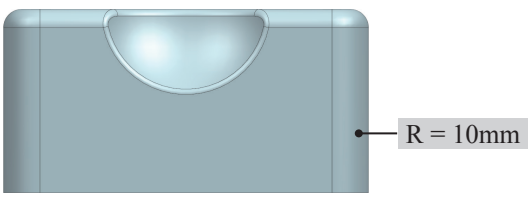


Fig 6-44 Front View

END of Exercise