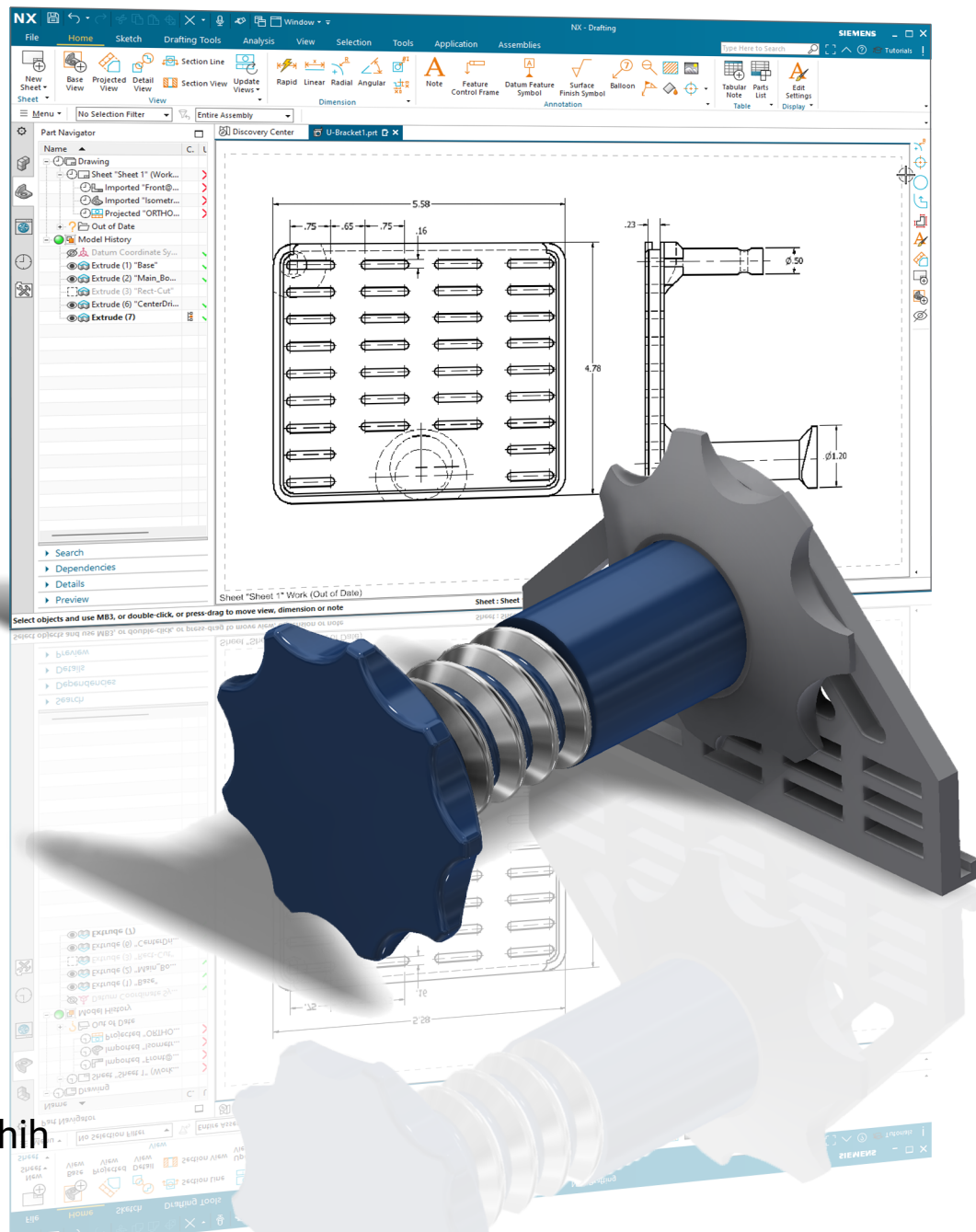


Parametric Modeling with SIEMENS® NX®

Spring 2022 Edition



Randy H. Shih

Visit the following websites to learn more about this book:



[amazon.com](https://www.amazon.com)

[Google books](https://books.google.com)

[BARNES & NOBLE](https://www.barnesandnoble.com)

Table of Contents

Preface

Acknowledgments

Chapter 1

Introduction - Getting Started

| | |
|--|------|
| Introduction | 1-2 |
| Development of Computer Geometric Modeling | 1-2 |
| Feature-Based Parametric Modeling | 1-6 |
| Getting Started with NX | 1-7 |
| The Siemens NX Main Window | 1-8 |
| Siemens NX Screen Layout | 1-10 |
| Quick Access Toolbar | 1-11 |
| Ribbon Bar | 1-11 |
| Zoom Toolbar | 1-11 |
| Additional Tools | 1-11 |
| Message and Status Bar | 1-12 |
| Part Navigator | 1-12 |
| Resource Bars | 1-12 |
| Mouse Buttons | 1-13 |
| [Esc] - Canceling commands | 1-14 |
| Online Help | 1-14 |
| Leaving Siemens NX | 1-14 |
| Creating a CAD Files Folder | 1-15 |

Chapter 2

Parametric Modeling Fundamentals

| | |
|---|------|
| Introduction | 2-2 |
| The Adjuster design | 2-3 |
| Step 1: Starting Siemens NX and Units setup | 2-3 |
| Siemens NX Application Screen Layout | 2-5 |
| Step 2: Determine/Set Up the First Solid Feature | 2-6 |
| Work Plane – It is an XY CRT, but an XYZ World | 2-7 |
| Creating Rough Sketches | 2-9 |
| Step 3: Creating a Rough 2D Sketch | 2-10 |
| Geometric Constraint Symbols | 2-11 |
| Step 4: Apply/Modify Constraints and Dimensions | 2-12 |
| View Functions | 2-17 |
| Dynamic Viewing Functions | 2-17 |
| Step 5: Completing the Base Solid Feature | 2-18 |
| Display Orientations | 2-19 |
| Dynamic Viewing – Icons, Mouse buttons and Quick keys | 2-20 |

| | |
|--------------------------------------|------|
| Display Modes | 2-22 |
| Step 6-1: Adding an Extruded Feature | 2-23 |
| Step 6-2: Adding a Cut Feature | 2-27 |
| Step 6-3: Adding another Cut Feature | 2-30 |
| Save the Model and Exit Siemens NX | 2-34 |
| Review Questions | 2-35 |
| Exercises | 2-36 |

Chapter 3

Constructive Solid Geometry Concepts

| | |
|-------------------------------------|------|
| Introduction | 3-2 |
| Binary Tree | 3-3 |
| The Locator Design | 3-4 |
| Modeling Strategy - CSG Binary Tree | 3-5 |
| Starting Siemens NX | 3-6 |
| Base Feature | 3-7 |
| Use the Rectangle Command | 3-9 |
| Completing the Base Solid Feature | 3-10 |
| Creating the Next Solid Feature | 3-11 |
| Creating a Cut Feature | 3-14 |
| Creating a Placed Feature | 3-17 |
| Creating a Rectangular Cut Feature | 3-19 |
| Review Questions | 3-23 |
| Exercises | 3-24 |

Chapter 4

Model History Tree

| | |
|---|------|
| The BORN Technique | 4-2 |
| Model History Tree | 4-3 |
| The Saddle Bracket Design | 4-4 |
| Starting Siemens NX | 4-4 |
| Modeling Strategy | 4-5 |
| Apply the BORN Technique | 4-7 |
| The NX Part Navigator | 4-12 |
| Create the Second Solid Feature | 4-13 |
| Use More Meaningful Feature Names | 4-16 |
| Adjust the Width of the Base Feature | 4-17 |
| Add a Placed Feature | 4-19 |
| Create a Rectangular Cut Feature | 4-21 |
| History-based Part Modifications | 4-25 |
| A Design Change | 4-26 |
| Assign and Calculate the Associated Physical Properties | 4-28 |
| Review Questions | 4-33 |

| | |
|-----------|------|
| Exercises | 4-34 |
|-----------|------|

Chapter 5

Parametric Constraints Fundamentals

| | |
|---|------|
| Constraints and Relations | 5-2 |
| Starting Siemens NX | 5-3 |
| Display Existing Constraints | 5-6 |
| Apply Geometric Constraints Implicitly | 5-7 |
| Apply a Geometric Constraint Explicitly | 5-8 |
| Add Dimensional Constraints | 5-9 |
| A Fully Constrained Sketch | 5-11 |
| A Fully Constrained Sketch – Alignment to Sketch Origin | 5-12 |
| A Fully Constrained Sketch – Add location dimensions | 5-13 |
| Delete Existing Dimensions and Constraints | 5-14 |
| 2D Sketches with Multiple Loops | 5-17 |
| Parametric Relations | 5-20 |
| Dimensional Values and Dimensional Variables | 5-21 |
| Review Questions | 5-26 |
| Exercises | 5-27 |

Chapter 6

Geometric Construction Tools

| | |
|--|------|
| Introduction | 6-2 |
| The Gasket Design | 6-2 |
| Modeling Strategy | 6-3 |
| Starting NX | 6-4 |
| Create the Sketch of the Base Feature | 6-5 |
| Edit the Sketch by Dragging the Entities | 6-7 |
| Add Additional Constraints | 6-9 |
| First Construction Method – Trim/Extend | 6-10 |
| Create Fillets and Completing the Sketch | 6-13 |
| Complete the Extrusion Feature | 6-14 |
| Second Construction Method – Haystack Geometry | 6-15 |
| Use the NX Selection Intent Option | 6-20 |
| Create an Associative OFFSET Cut Feature | 6-22 |
| Review Questions | 6-26 |
| Exercises | 6-27 |

Chapter 7

Parent/Child Relationships

| | |
|----------------------|-----|
| Introduction | 7-2 |
| The U-Bracket Design | 7-3 |

| | |
|--|------|
| Create the Base Feature | 7-4 |
| Complete the Base Feature | 7-6 |
| The Implied Parent/Child Relationships | 7-7 |
| Create the Second Solid Feature | 7-8 |
| Fully Constrained 2D Sketch | 7-10 |
| Complete the Extrude Feature | 7-11 |
| Creating a Subtract Feature | 7-12 |
| Another Subtract Feature | 7-13 |
| Examine the Parent/Child Relationships | 7-15 |
| A Design Change | 7-16 |
| Feature Suppression | 7-17 |
| A Different Approach to the CENTER_DRILL Feature | 7-19 |
| Examine the Parent/Child Relationships | 7-20 |
| Suppress the Rect_Cut Feature | 7-21 |
| Create a Hole Feature | 7-22 |
| A Flexible Design Approach | 7-23 |
| Review Questions | 7-24 |
| Exercises | 7-25 |

Chapter 8

Part Drawings and Associative Functionality

| | |
|--|------|
| Drawings from Parts and Associative Functionality | 8-2 |
| Start NX | 8-3 |
| Drawing Mode - 2D Paper Space | 8-3 |
| NX Drafting Mode | 8-4 |
| Add a Base View | 8-5 |
| Drawing Display Option | 8-7 |
| Change the Size of the Drawing Sheet | 8-7 |
| Turn Off the Datum Coordinate System | 8-9 |
| Text Orientation Setup | 8-10 |
| Display Feature Dimensions | 8-11 |
| Adjust the Display of Tangency Edges | 8-15 |
| Edit the Display of Arrows on Diameter Dimensions | 8-16 |
| Hide Feature Dimensions | 8-17 |
| Unhide the Hidden Dimensions | 8-18 |
| Delete Feature Dimensions | 8-19 |
| Add Center Marks | 8-20 |
| Add Additional Dimensions – Reference Dimensions | 8-21 |
| Change the Dimension Appearance | 8-22 |
| Associative Functionality – Modifying Feature Dimensions | 8-23 |
| Review Questions | 8-26 |
| Exercises | 8-27 |

Chapter 9

Datum Features and Auxiliary Views

| | |
|--|------|
| Datum Features | 9-2 |
| Auxiliary Views in 2D Drawings | 9-2 |
| The Rod-Guide Design | 9-2 |
| Modeling Strategy | 9-3 |
| Start NX | 9-4 |
| Create the Base feature | 9-4 |
| Create an Angled Datum Plane | 9-8 |
| Create an Extruded Feature Using the Datum Plane | 9-10 |
| Apply Proper Constraints | 9-11 |
| Create an Offset Datum Plane | 9-14 |
| Create a Hole Feature Using the New Datum Plane | 9-15 |
| Create a Title Block Template | 9-18 |
| Use the Export File Command | 9-22 |
| Reopen the Rod Guide Design | 9-23 |
| Import the Title Block | 9-24 |
| Add a Base View | 9-25 |
| Create an Auxiliary View | 9-26 |
| Turn Off the Datum Planes and Reference Labels | 9-28 |
| Turn Off the Display Borders Option | 9-29 |
| Add another Base View | 9-30 |
| Loading the ASME Drafting Standard | 9-31 |
| Display Feature Dimensions | 9-32 |
| Delete and Add Dimensions | 9-34 |
| Review Questions | 9-36 |
| Exercises | 9-37 |

Chapter 10

Introduction to 3D Printing

| | |
|--|-------|
| What is 3D Printing? | 10-2 |
| Development of 3D Printing Technologies | 10-3 |
| Primary types of 3D Printing processes | 10-6 |
| Stereolithography | 10-6 |
| Fused Deposition Modeling & Fused Filament Fabrication | 10-7 |
| Laser Sintering / Laser Melting | 10-8 |
| Primary 3D Printing Materials for FDM and FFF | 10-9 |
| From 3D model to 3D printed Part | 10-11 |
| Start NX | 10-12 |
| Export the Design as an STL file | 10-13 |
| Using the 3D Printing software to create the 3D Print | 10-14 |
| Questions | 10-21 |

Chapter 11

Symmetrical Features in Designs

| | |
|--|-------|
| Introduction | 11-2 |
| A Revolved Design: PULLEY | 11-2 |
| Modeling Strategy - A Revolved Design | 11-3 |
| Start NX | 11-4 |
| Create the Base Feature | 11-4 |
| Completing the Sketch and Creating the Feature | 11-6 |
| Mirroring Features | 11-8 |
| Join the Two Solid Features | 11-10 |
| Create a Pattern Leader | 11-11 |
| Circular Array | 11-13 |
| Create a New Drawing in the Drafting Mode | 11-15 |
| Import the Predefined Title Block | 11-16 |
| Create 2D Views | 11-17 |
| Add a Section View | 11-18 |
| Turn Off the Datum Features | 11-20 |
| Add Dimensions | 11-21 |
| Adjust the Display of the Views | 11-23 |
| Turn Off the Display Borders Option | 11-26 |
| Associative Functionality – A Design Change | 11-27 |
| Review Questions | 11-30 |
| Exercises | 11-31 |

Chapter 12

Advanced 3D Construction Tools

| | |
|-------------------------------------|-------|
| Introduction | 12-2 |
| A Thin-Walled Design: Dryer Housing | 12-2 |
| Modeling Strategy | 12-3 |
| Start NX | 12-4 |
| Create the Base Feature | 12-4 |
| Create a Revolved Feature | 12-7 |
| Create the Dryer Handle | 12-8 |
| Create another Extruded Feature | 12-10 |
| Create 3D Rounds and Fillets | 12-13 |
| Create a Shell Feature | 12-15 |
| Create a Pattern Leader | 12-16 |
| Creating a Rectangular Array | 12-19 |
| Create a Swept Cut Feature | 12-22 |
| Define the Sweep Section | 12-22 |
| Create the Swept Feature | 12-24 |
| Review Questions | 12-26 |
| Exercises | 12-27 |

Chapter 13

Basic Sheet Metal Designs

| | |
|---|-------|
| Sheet Metal Processes | 13-2 |
| Sheet Metal Modeling | 13-4 |
| K-Factor (Neutral Factor) | 13-5 |
| The Actuator Bracket Design | 13-6 |
| Start NX | 13-7 |
| Sheet Metal Preferences | 13-8 |
| Create the Base Feature of the Design | 13-9 |
| Create a Cut Feature with the Extrude Command | 13-11 |
| Create a Flange Feature | 13-14 |
| Confirm the Flange Location | 13-16 |
| Add another Extruded Feature | 13-17 |
| Create a Bend Feature | 13-19 |
| Create Mirrored Features | 13-22 |
| Create a 2D Sheet Metal Drawing | 13-24 |
| Import the Pre-Defined Title Block | 13-25 |
| Create 2D Views | 13-26 |
| Create the Associated Flat Pattern View | 13-27 |
| Confirm the Flattened Length | 13-31 |
| Set up Dimensions Preferences | 13-33 |
| Review Questions | 13-35 |
| Exercises | 13-36 |

Chapter 14

Assembly Modeling - Putting It All Together

| | |
|---|-------|
| Introduction | 14-2 |
| The Shaft Support Assembly | 14-2 |
| Assembly Modeling Methodology | 14-3 |
| Additional Parts | 14-4 |
| (1) Collar | 14-4 |
| (2) Bearing | 14-4 |
| (3) Base-Plate | 14-5 |
| (4) Cap-Screw | 14-5 |
| Start NX | 14-6 |
| Loading and Placing the First Component | 14-7 |
| Place the Second Component | 14-9 |
| Degrees of Freedom | 14-10 |
| Assembly Constraints | 14-12 |
| Apply the First Assembly Constraint | 14-15 |
| Apply another Align Constraint | 14-16 |
| Constrained Move | 14-17 |
| Show Degrees of Freedom | 14-19 |
| Apply another Assembly Constraint | 14-20 |

| | |
|--|-------|
| Placing the Third Component | 14-22 |
| Apply Assembly Constraints on Datum Planes | 14-25 |
| Assemble the First Cap-Screw | 14-26 |
| Placing the Second Cap-Screw Part | 14-29 |
| Exploded View of the Assembly | 14-30 |
| Edit the Components | 14-34 |
| Set up a Drawing of the Assembly Model | 14-37 |
| Importing the Title Block | 14-37 |
| Create a Parts List | 14-39 |
| Complete the Assembly Drawing | 14-39 |
| Summary of Modeling Considerations | 14-41 |
| Review Questions | 14-42 |
| Exercises | 14-43 |

Chapter 15

Advanced Assembly Modeling and Animation

| | |
|--|-------|
| Introduction | 15-2 |
| NX Motion Simulation | 15-2 |
| Motion Bodies | 15-3 |
| Joint Connections | 15-3 |
| The Crank-Slider Assembly | 15-6 |
| Creating the Required Parts | 15-6 |
| (1) End Cap | 15-6 |
| (2) Connecting Rod | 15-7 |
| (3) Base Block | 15-8 |
| (4) Crank Shaft | 15-9 |
| (5) Piston | 15-10 |
| Create the Crank Slider Assembly Model | 15-11 |
| Loading and Placing the First Component | 15-12 |
| Assembling the Crank Shaft | 15-14 |
| Assembling the Connecting Rod | 15-16 |
| Complete the Assembly | 15-17 |
| Start the NX Motion Simulation Module | 15-19 |
| Defining a New Simulation | 15-20 |
| Define the Motion Bodies | 15-21 |
| Define the Joint Connections | 15-23 |
| Set up a Motion Driver for the Animation | 15-30 |
| Set up an Animation Analysis | 15-31 |
| View the Animation | 15-32 |
| Output the Animation as a Video file | 15-33 |
| Conclusion | 15-34 |
| Review Questions | 15-35 |
| Exercises | 15-36 |

Appendix A

Index