FIRST Robotics Team 1719 CAD Lesson Directory for 2013/2014 Season

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Green Highlighted Text (also indicated with a ☆ so that you can see which ones are green if printing out the table in black and white) – indicates basic lessons that will be useful to all Team 1719 students with interest in CAD Basics

Yellow Highlighted Text – indicates more advanced lessons that will be required by members of the CAD Subteam and any other team members that want to have a higher level involvement in part design, sheet metal design, virtual assembly and creating engineering drawing

Unhighlighted Text – indicates lessons that are not likely going to be useful to Team 1719 Robotics design, at least not until the basics (green and yellow highlighted) are mastered. However, please feel free to peruse these lessons, at least briefly, once the yellow and green topics are mastered). Also, some of these topics may be referred to on an as needed basis for specific design needs.

☆

I. Solid Modeling

Solid Modeling

- Introduction
- Getting Started
- The Open Dialog Box
- Create a Project
- Overview of the User Interface
- The Heads Up Display
- Create a Sketch
- Sketch Constraints
- Extruding a Profile
- The In-Canvas Display
- Mini-Toolbar Customization
- The Marking Menu
- Marking Menu Customization
- Editing Profiles
- View Cube and Navigation Bar
- Sketches vs Profiles
- Solid Bodies
- Template View Orientation
- Constraining Profiles
- Creating Profiles From Solids
- More Mini-Toolbars
- Default Work Planes
- Revolve a Feature
- Trick for Constraining Sketches
- Constraining the Axis of Revolution
- Projecting Geometry
- Creating Work Planes
- Extruding to a Plane
- Sharing Sketches
- Construction Lines
- Centerlines
- Mirroring Features
- Circular Feature Array
- Rectangular Feature Array
- Application Options
- Creating Holes
- Placing Holes Part I
- Placing Holes Part II
- Creating Hole Patterns Part I
- Creating Hole Patterns Part II
- Threaded Holes
- Advanced Thread Settings
- Finishing Features
- Clearance Holes
- Pipe Thread Holes
- Fundamentals of the Shell Command
- Using the Shell Command
- 3D Construction Stage I
- 3D Construction Stage II
- 3D Construction Stage III
- Breaking Rules
- Ribs Parallel to Sketch
- Ribs Perpendicular to Sketch
- Draft and Ejector Pads
- Control Vertex Splines
- Bridge Curve Splines
- Interpolation Splines
- Constraining Splines
- Tweaking Splines
- Bowties
- Fit and Tension
- Sweep
- Sweep Path and Guide Rail
- Sweep Path and Guide Surface
- Introduction to 3D Sketches
- Using 3D Sketches
- 3D Splines and Coils
- Mirroring Sketch Geometry
- Editing Mirrored Sketches
- Automating Patterns
- Linear Slots
- Arced Slots
- Lofts
- Loft Conditions
- Loft Transition and Point Mapping
- Lofts with Rails
- Rails on Cylindrical Lofts
- Tricks for Round Spline Sweeps
- Square Sweeps
- Centerline Lofts
- Skin Bodies
- Adjusting Color
- Closed Loop Lofts
- Area Lofts
- Loft Strategies
- The Lip Command
- Coils and Springs
- Parameters and Tolerances
- Linking Excel Spreadsheets
- Threads
- Importing Points
- The Bend Part Command
- Bending Conical and Loft Parts
- Moving Faces
- The Emboss Command
- The Boss Command Part I
- The Boss Command Part II
- Ribs on Bosses
- The Rest Command
- The Grill Command
- Rule Fillets
- Replacing and Splitting Faces
- The Sculpt Command
- Modifying and Stitching Surfaces
- Patch Stitch IGES Files I
- Patch Stitch IGES Files II
- Editing a Solid - Move Faces
- Editing a Solid - Offset
- Editing a Solid - Extend Contract
- 2D Equation Curves
- 3D Equation Curves
- Conclusion

II. Assemblies and Advanced Concepts

Assemblies and Advanced Concepts

Introduction
Sketch Origin Node
Using and Creating Templates

Creating Derived Parts
Editing Derived Parts

Intro to the Assy Environment
Degrees of Freedom
Driving Constraints

Explicit Reference Vectors
Adaptive Parts and Sketches
Adaptive Constraint Strategies
Creating Adaptive Parts I
Creating Adaptive Parts II
Using Constraint Strategies
Removing Adaptivity
Driving Adaptive Assemblies

The Content Center
The Symmetry Constraint
Ball Joints
Planar Joints
Joint Alignment Details
Cylindrical Joints
Slider Joints
Rotational Joints
Rigid and Automatic Joints
Mirrored Assemblies
Mirrored and Copied Constraints

Flexible Assemblies
Copied Assemblies
Pattern Components
Advanced Viewing
Assembly Viewing
Motion Constraints
Animating Gears
Transitional Constraints
Collision Detection
Contact Solver
Checking for Interferences
Creating Compressible Springs
Driving Adaptive Springs
Positional Representations
Creating Presentations
Editing Tweaks
Animating Presentations

iFeature Design
Inserting iFeatures
Reusing Part Features
Advanced iFeature Design
Reducing Dangling Geometry
Creating iPart Factories
iPart Members
Editing the iPart Author
iMates and iParts
Custom iParts

Creating iPart Assemblies
Updating iParts
Threaded iParts
iMates and the Content Center
Identifying and Using iMate Glyphs
Inferred iMates
Scaling Parts
Combining Parts I
Combining Parts II
Subtracting and Splitting Parts
Deleting Faces
Strategy for Splitting Parts
Trick for Measuring Interferences
Prep for Design Accelerator
Bolted Connections
Generating Bearings
Generating Shafts Part I
Generating Shafts Part II
Generating Shafts Part III
Generating Gears
Generating Keyways
Advanced Spring Design I
Advanced Spring Design II
Animating Springs

Working with Large Assemblies
Level of Detail
Shrinkwrapping Components

Skeletal Modeling Introduction
Make Part and Components
Kinematics
Sketch Blocks
Advanced Top Down Design
Blocks and Assemblies
Modeling Techniques I
Modeling Techniques II
Flexible Block Assemblies
Hybrid Design Methods
Alternate Slice Method
Import Assy to Part File
Middle Out Design
Exporting Bodies to an Assembly
Replacing Assemblies
The Assemble Command
Sinusoidal Conical Sweeps
Alternate Split Part Methods
Appearances on Derived Feature
Selecting a Design Strategy
Practice with Relationships
Inverted Text
Conclusion

III. 2D Drafting and Customization

2D Drafting and Customization

- Introduction
- Introduction to Drawings
- Drawing Views
- Custom Predefined Template Views
- Customizing Backgrounds
- Custom Borders
- Custom Title Blocks
- Property Field Types
- File iProperties
- Drawing Projects
- Bill of Materials
- Content Center Parts in BOMs
- BOM Levels and Part Lists
- BOM Structures
- Replacing Content Center Parts
- Exporting BOMs
- Parts Lists
- Editing a Parts List
- Customizing a Parts List
- Balloons
- Break Out Views
- Overlay Views
- Crop Command
- Slice Command
- View Alignment
- Hole Tables
- Administration Projects
- Custom Parts List Style
- Custom Drafting Styles
- Custom Dimensioning Style Part I
- Custom Dimensioning Style Part II
- Notes and Leader Callouts
- More Drafting Styles
- Custom Text Styles
- Dimensioning Drawings Part I
- Dimensioning Drawings Part II
- Dimensioning Drawings Part III
- Bolt Circles and Section Lines
- Sketched Symbols and Notes
- Templates and Styles Part I
- Templates and Styles Part II
- **Migrating Inventor Drawing Styles**
- Custom Material Libraries
- Customizing Materials
- Material Projects
- Custom Appearance Libraries
- Using Custom Appearances
- Details of Appearance Settings
- Custom Physical Assets
- Appearances From Images
- Materials From Scratch
- Migrating Older Styles
- Custom Ribbon Panels
- Shortcut Keys and Command Aliases
- Customizing the Marking Menu
- User Interface Visibility
- Object Visibility
- Constraint Options and Persistence
- Applying Your Skills Part I
- Applying Your Skills Part II
- Applying Your Skills Part III
- Opening and Modifying AutoCAD DWGs
- Creating Solids from AutoCAD DWGs
- Inventor DWG Files
- Exporting and Importing DWG Files
- Translating AutoCAD to Inventor
- Conclusion

IV. Sheet Metal Design

Sheet Metal Design

Introduction
The Sheet Metal Environment
Styles and Templates
K-Factors
Creating Bend Tables
The Flange Command
Bend Reliefs and Remnants
Bend and Sheet Metal Styles
Unfold Methods
Corner Seams
Corner Seam Reliefs
Bend Transitions and Flat Patterns
Custom Sheet Metal Templates
The Contour Flange Command
Looped Contour Flanges
Shells and Ripped Seams
Editing Flat Patterns
Using the Hem Command
Multiple Plates in Assemblies I
Multiple Plates in Assemblies II
Extended Surfaces

Using the Punch Tool
Custom Punches
Flat Pattern Punch Representations
Custom Extruded Louver Punch
Dangling Geometry in Punches
Custom Extruded Dimple Punch I
Custom Extruded Dimple Punch II
Custom Revolved Dimple Punch
Sheet Metal Commands and Punches
Surfaces
G2 Fillets
Tabs
Double Bends and Bend Allowances
Applying Bend Allowances
Knockouts
Flat Patterns on Drawings
Custom Sweep Punches
Complex Shapes
Sheet Metal Cone
Contour Roll Unrolling Unfolding
Press Break Lofted Flanges

Square to Round Transitions
Adding Flanges to Lofted Flanges
Editing with Unfold and Refold
Lofted and Rolled Part Strategies
Formed Punches and Features
Custom Structural Shapes I
Custom Structural Shapes II
Publishing Multiple Shapes
Frame Skeletons
Generating Custom Shape Frames I
Generating Custom Shape Frames II
Generating Custom Shape Frames III
Generating Custom Shape Frames IV
Trimming Members
Model Frame Skeletons
More Frame Generator Concepts
Editing Frames
Preparations and Welds
Fillet and Post Weld Operations
Multi-Body Sheet Metal Modeling
Features on Multi-Body Sheets

Multi-Body Sheet Metal Bends
More Multi-Body Practice
Multi-Body Sheet Metal Assembly
Modifying Multi-Body Components
Finalizing the Design
Convert to Sheet Metal Parts
Sheet Metal Drawings
Export Flat Pattern to DXF
Custom Exported Layers
Details of Exported DXF Files
Converting Down Bends to Up Bends
Edit Flat Pattern Definition
Bend Callouts and Tables
Bend Order
Flat Pattern Extents
Compare Drawing to DXF
Conclusion