MFG321690

Fusion 360 – CAM Fundamental Workflows

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Learning Objectives

- Discover CAM milling and turning setups by defining stock size and work coordinate systems
- Discover the difference between turning toolpaths strategies and milling operations
- Learn about effective workflows with geometry-driven operation templates
- Learn how to verify an efficient integrated approach to product prototype development

Description

This class will focus on Fusion 360 CAM fundamentals for both new and current users by investigating workflows in the Manufacture workspace. Demonstrating how simple it is to use Fusion 360 CAM, we'll apply turning and 2D milling operations with geometry selections that drive them, and learn how geometry-based toolpaths can be applied using 3D milling strategies. Attendees will learn how to verify toolpaths with full stock simulation, create setup sheets, and post process G-code for their machines. These foundational concepts will help new users understand the benefits of truly integrated CAD/CAM using Fusion 360 to seamlessly update all toolpaths when CAD revision or design changes are required. This class will help you learn how to make anything with Fusion 360.

Speaker(s)

Kevin is an innovative entrepreneur specialized with integrated CAD/CAM manufacturing technology solutions. He graduated with a Mechanical Engineering diploma continuing his education with a tool maker apprenticeship with focus on CNC manufacturing various projects such as wind tunnel model sky scrapers and specialized aeroelastic instruments with the University of Western Ontario for sixteen years.

His continued education with Western Engineering focused on effective leadership led him to a successful part time college teaching career as a CNC manufacturing professor extending his knowledge and experience to many of his students. Using this experience, Kevin provides leadership as managing director of his own company LeeVerage Integration Inc. located in southwestern Ontario, Canada.

Kevin's focus on integrated CAD/CAM solutions provides guidance to the firm and its clients looking for innovative technologies that deliver competitive advantage with long term sustainability. Kevin extends dedicated on-demand software cam support and training services to our clients allowing them to compete at a world class level utilizing Autodesk's HSM cam manufacturing products like Fusion 360, Inventor Cam, and HSMWorks

Fusion 360 - Defining a Milling or Turning Setup

Setup Tab

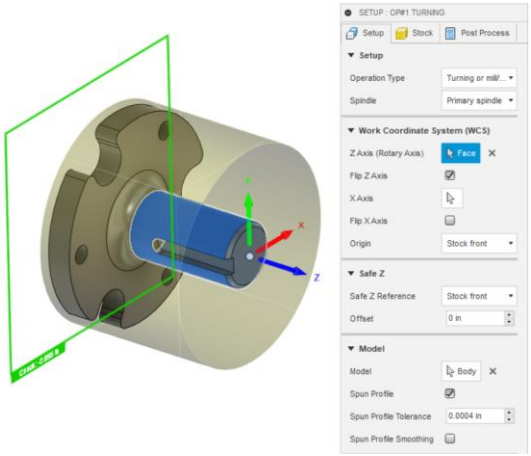
- Ensure Operation Type is set to either Milling, Turning or Mill/Turn
- Define Z axis (rotary axis) with visual blue arrow direction
- Determine Origin position (program zero)

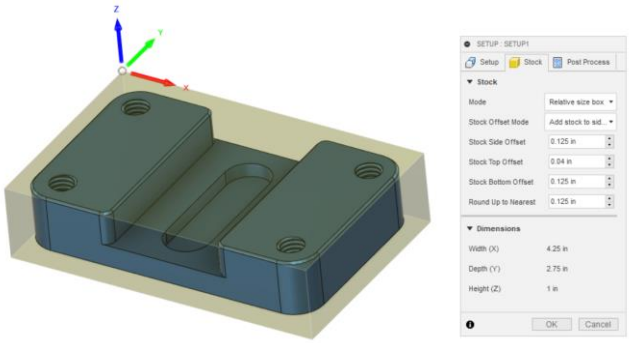
Stock Tab

- Establish stock definition/size– relative size vs fixed size
- Set Stock offsets

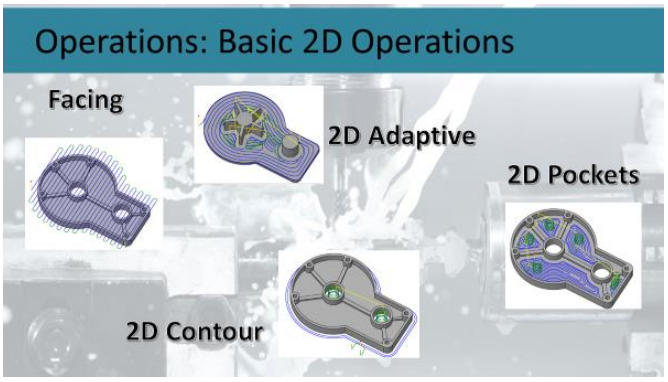
Post Process Tab

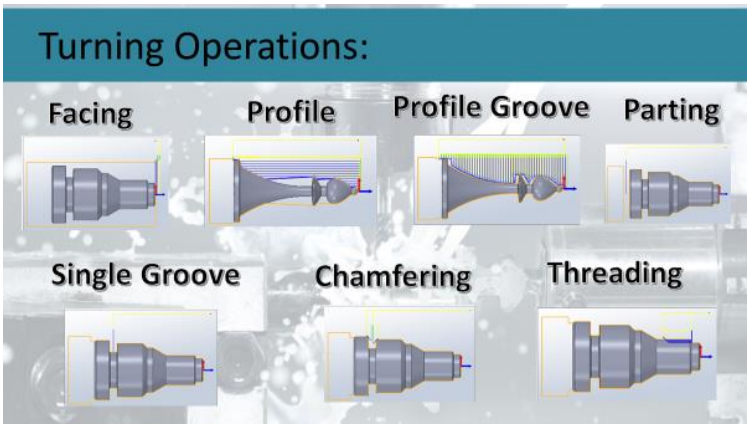
- Decide on a program number
- Define Program Comment, program name that can be identified on machine controller
- Set WCS Offset to use in Gcode program (ex. G54, G55, etc.)

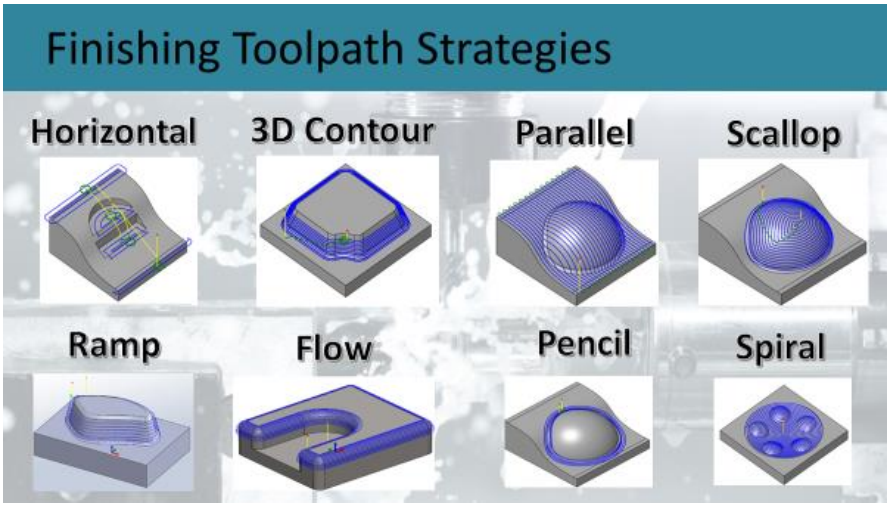




Fusion 360 – Milling and Turning Toolpath Strategies







Fusion 360 - Setup Sheet Documentation

Setup Sheet for Program 001

PROGRAM COMMENT: Turning OP1
JOB DESCRIPTION: Op#1 Turning
DOCUMENT PATH: Fusion Academy Turning v20

Setup

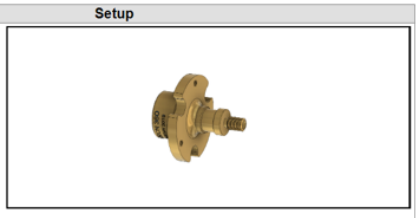
WCS: #1

STOCK:
DX: 3.375in
DY: 3.375in
DZ: 3.425in

PART:
DX: 3.185in
DY: 3.25in
DZ: 3.375in

STOCK LOWER IN WCS #1:
X: -1.687in
Y: -1.687in
Z: -3.4in

STOCK UPPER IN WCS #1:
X: 1.687in
Y: 1.687in
Z: 0.025in



Setup Sheets

Generates an overview of the NC program for the CNC operator. Provides tool data, stock and work piece position, and machining statistics. The setup sheet is fully customizable.

Total

NUMBER OF OPERATIONS: 7
NUMBER OF TOOLS: 6
TOOLS: **T6 T7 T8 T9 T10 T11**
MAXIMUM Z: 0.625in
MINIMUM Z: -3.469in
MAXIMUM FEEDRATE: 29in/min
MAXIMUM SPINDLE SPEED: 3670rpm
CUTTING DISTANCE: 92.986in
RAPID DISTANCE: 271.49in
ESTIMATED CYCLE TIME: 29m:52s

Tools

T6 D0
TYPE: general turning
INSERT: ISO C 80deg
INSCRIBED CIRCLE: 0.381in
NOSE RADIUS: 0.031in
CROSS SECTION: T
TOLERANCE: M
RELIEF: N 0deg
COMPENSATION: Tip tangent
DESCRIPTION: CNMT Right Hand
MINIMUM Z: -2.506in
MAXIMUM FEED: 25in/min
MAXIMUM SPINDLE SPEED: 500rpm
CUTTING DISTANCE: 68.375in
RAPID DISTANCE: 64.951in
ESTIMATED CYCLE TIME: 24m:5s (80.7%)
HOLDER: ISO L Right

T7 D0
TYPE: groove turning
INSERT: Square
WIDTH: 0.125in
NOSE RADIUS: 0.01in
COMPENSATION: Tip
DESCRIPTION: OD Grooving
MINIMUM Z: -1.57in
MAXIMUM FEED: 16.4643in/min
MAXIMUM SPINDLE SPEED: 500rpm
CUTTING DISTANCE: 4.147in
RAPID DISTANCE: 7.107in
ESTIMATED CYCLE TIME: 39s (2.1%)
HOLDER: External Right

T8 D0
TYPE: general turning
INSERT: ISO V 35deg
INSCRIBED CIRCLE: 0.381in
NOSE RADIUS: 0.008in
CROSS SECTION: T
TOLERANCE: M
RELIEF: N 0deg
COMPENSATION: Tip tangent
DESCRIPTION: VNMT Right Hand
MINIMUM Z: -2.483in
MAXIMUM FEED: 13.64975in/min
MAXIMUM SPINDLE SPEED: 500rpm
CUTTING DISTANCE: 11.809in
RAPID DISTANCE: 12.503in
ESTIMATED CYCLE TIME: 3m:14s (10.8%)
HOLDER: ISO L Right

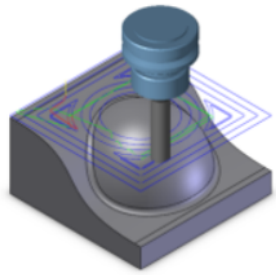
Operations

Operation 1/7
DESCRIPTION: Face2
STRATEGY: Turning Face
WCS: #1
TOLERANCE: 0in
MAXIMUM STEPOVER: 0.02in
MAXIMUM Z: 0.062in
MINIMUM Z: 0in
SURFACE SPEED: 300ft/min
FEEDRATE PER REV: 0.005in
CUTTING DISTANCE: 4.045in
RAPID DISTANCE: 4.598in
ESTIMATED CYCLE TIME: 1m:19s (4.4%)
COOLANT: Flood
T6 D0
TYPE: general turning
INSERT: ISO C 80deg
INSCRIBED CIRCLE: 0.381in
NOSE RADIUS: 0.031in
CROSS SECTION: T
TOLERANCE: M
RELIEF: N 0deg
COMPENSATION: Tip tangent
DESCRIPTION: CNMT Right Hand

Operation 2/7
DESCRIPTION: Profile3
STRATEGY: Turning Profile
WCS: #1
TOLERANCE: 0in
STOCK TO LEAVE: 0.02in
MAXIMUM STEPDOWN: 0.047in
MAXIMUM STEPOVER: 0.01in
MAXIMUM Z: 0.057in
MINIMUM Z: -2.506in
SURFACE SPEED: 300ft/min
FEEDRATE PER REV: 0.005in
CUTTING DISTANCE: 64.33in
RAPID DISTANCE: 60.353in
ESTIMATED CYCLE TIME: 22m:47s (76.3%)
COOLANT: Flood
T6 D0
TYPE: general turning
INSERT: ISO C 80deg
INSCRIBED CIRCLE: 0.381in
NOSE RADIUS: 0.031in
CROSS SECTION: T
TOLERANCE: M
RELIEF: N 0deg
COMPENSATION: Tip tangent
DESCRIPTION: CNMT Right Hand

Operation 3/7
DESCRIPTION: Profile3 (2)
STRATEGY: Turning Profile
WCS: #1
TOLERANCE: 0in
STOCK TO LEAVE: 0in
MAXIMUM STEPOVER: 0.005in
COMPENSATION: wear (center)
SAFE TOOL DIAMETER: < 0in
MAXIMUM Z: 0.057in
MINIMUM Z: -2.483in
SURFACE SPEED: 300ft/min
FEEDRATE PER REV: 0.005in
CUTTING DISTANCE: 11.809in
RAPID DISTANCE: 12.503in
ESTIMATED CYCLE TIME: 3m:14s (10.8%)
COOLANT: Flood
T8 D0
TYPE: general turning
INSERT: ISO V 35deg
INSCRIBED CIRCLE: 0.381in
NOSE RADIUS: 0.008in
CROSS SECTION: T
TOLERANCE: M
RELIEF: N 0deg
COMPENSATION: Tip tangent
DESCRIPTION: VNMT Right Hand

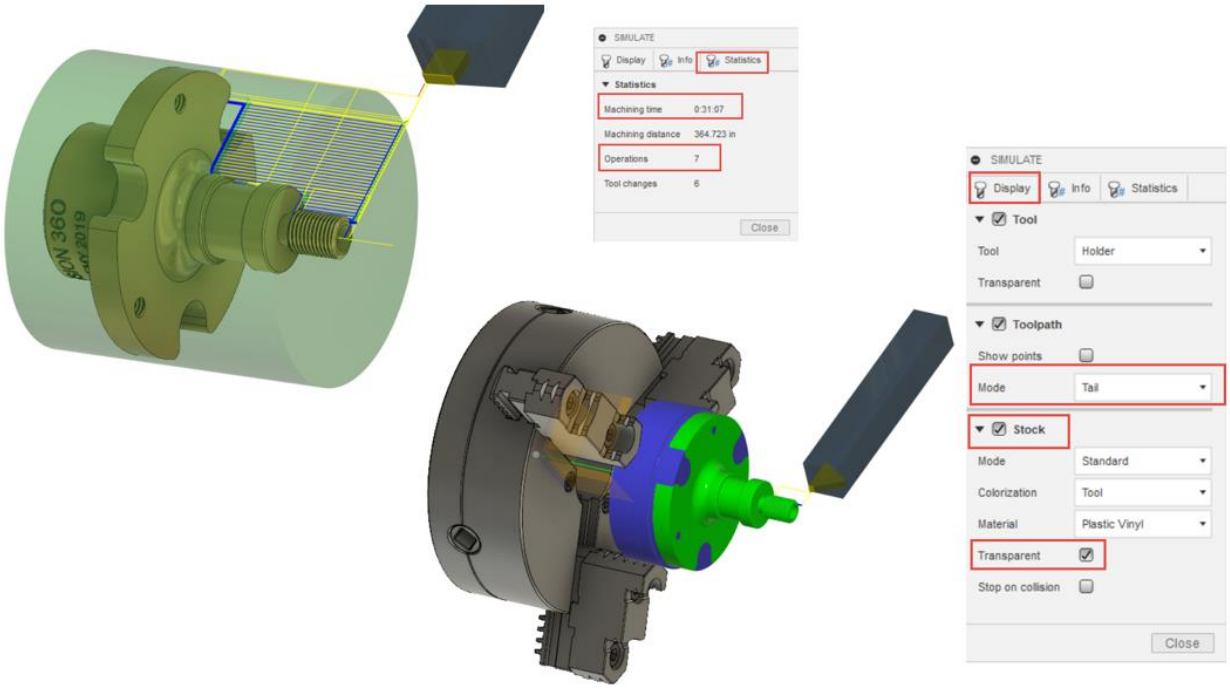
Fusion 360 - Validate with Stock Simulation



Stock Simulation

Previews and simulates toolpaths and stock material removal. Various controls include simulation speed and direction, visibility of tool, shaft and tool holder, as well as the coloring of rapid moves, lead moves, and cutting moves.

- Simulate all toolpaths to validate machining process and workflow
- Select full stock check box, and enable transparency
- Adjust toolpath mode to tail

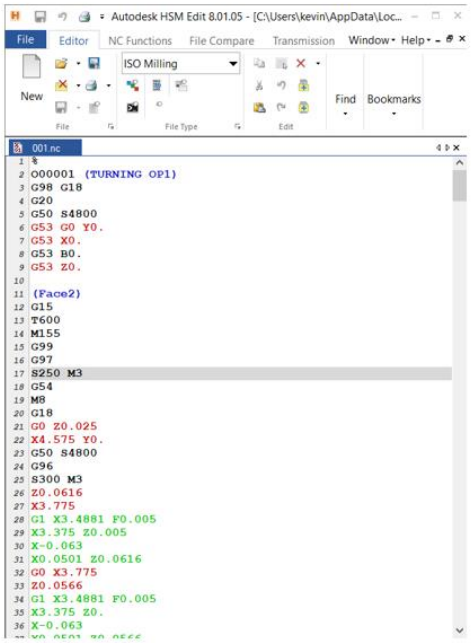


Fusion 360 - Post Processing G-Code

Post Processing

Converts the machine-independent cutter location data into machine-specific NC code.

Customizable post processor configurations are provided for all the commonly available CNC controls/machines.



AUTODESK® HSM

Post Library for Fusion 360 and Autodesk HSM

https://cam.autodesk.com/hsmposts

HAAS ST-20Y

DMG Mori NLX Mill/Turn

HAAS Turning

OKUMA LB3000

SIEMENS Mill-Turn

Fusion 360 - Integrated Product Development

- Consider effective geometry driven toolpath strategies
- Capture logical toolpath operations driven from model geometry
- Recognize connected workflows in Fusion 360 having integrated cad/cam efficiencies
- Deploy strategic machining templates for estimating subtractive manufacturing methods
- Validate estimated manufacturing machine run times