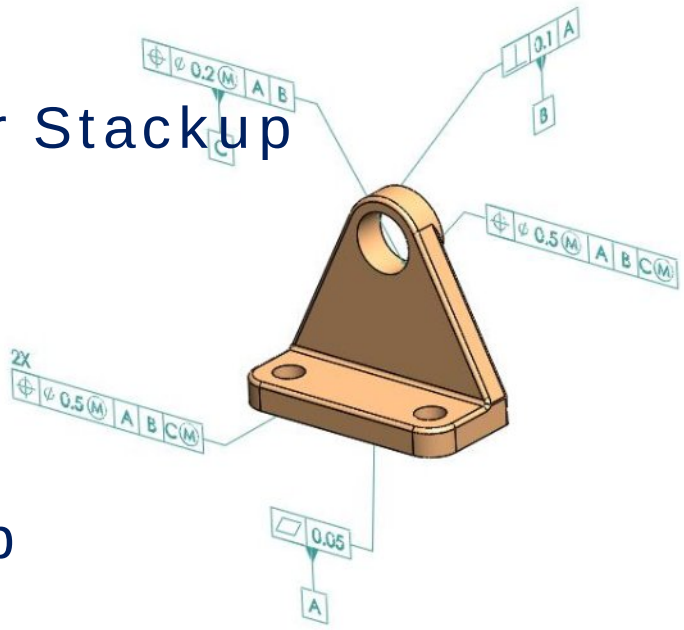
GEOMETRICAL DIMENSIONING AND TOLERANCE

AND

TOLERANCE STACK UP ANALYSIS

Tolerance Stack up

- ✓Tolerance stack up methods for GD&T and Plus Minus systems
- ✓Tolerance stack up using datum shift
- ✓Tolerance stack up using bonus and position tolerance
- ✓Creating Reports for Stackup
- ✓Profile Stackup
- ✓Boundary Stackup
- ✓Axial Stackup
- ✓Linear Stackup
- ✓Orientation Stack up

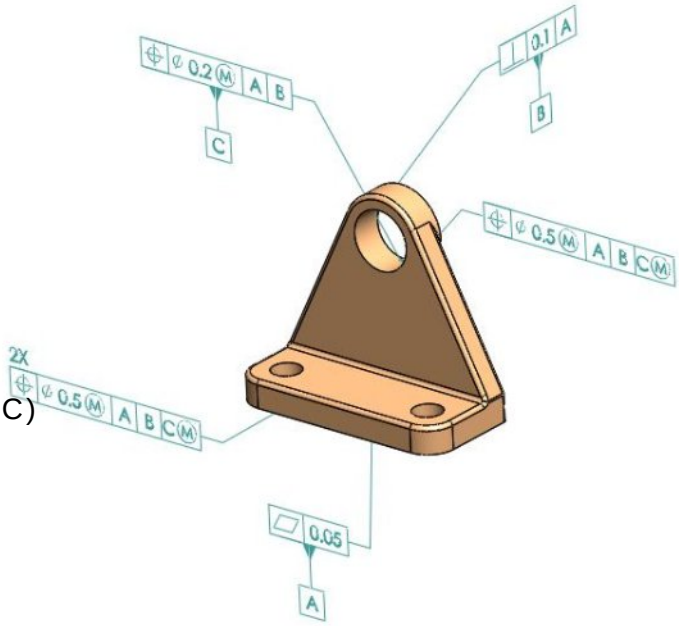


GD&T

DEFINITIONS,DIMENSIONING SYSTEMS

Topics:

- Datum
- Datum feature
- datum target
- dimension
- Basic dimension
- Reference dimension
- Feature
- Feature of size
- Full Indicator Movement (FIM)
- Least Material Condition (LMC)
- Maximum Material Condition (MMC)
- Regardless of Feature Size (RFS)
- actual size
- Limits of size
- Tolerance
- Bilateral tolerance
- geometric tolerance
- unilateral tolerance
- true position
- Virtual condition



SYMBOLS

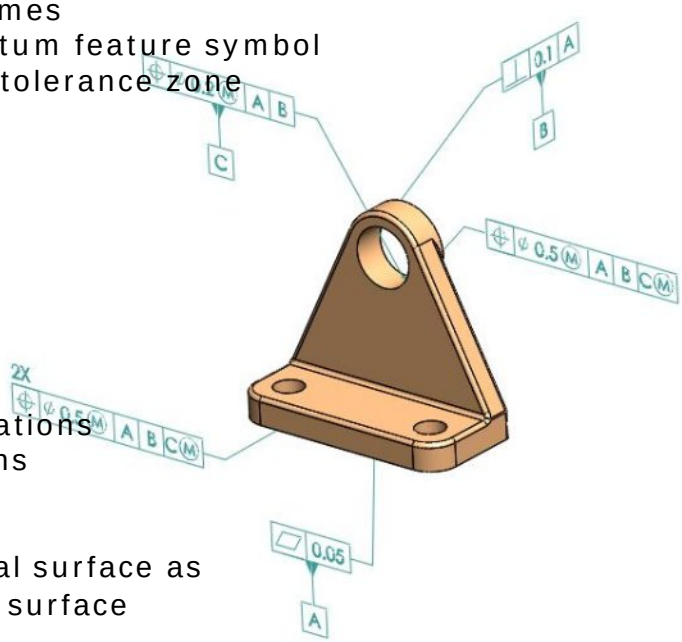
Topics

- straightness
- flatness
- circularity
- cylindricity
- profile of line
- profile of surface
- angularity
- perpendicularity
- parallelism
- position
- concentricity
- symmetry
- circular runout
- total runout

DATUM STRUCTURE

Topics

- Datum identifying letters
- Method of relating symbol frame to datum feature
- Datum Feature Identification
- Datum Feature Controls
- Datum Feature Order of Precedence
- Feature control frame
- Feature control frame incorporating one datum reference
- Composite feature control frame
- Two single-segment feature control frames
- Combined feature control frame and datum feature symbol
- Feature control frame with a projected tolerance zone



Sub-Topics

Establishing Datum's from

Datum Features

- Datum features not subject to size variations
- Datum features subject to size variations
- Multiple datum features
- Pattern of features
- Screw threads, gears, and splines partial surface as datum features mathematically defined surface
- Multiple datum reference frames
- Simultaneous versus separate requirements
- Simultaneous requirements and composite feature control

APPLICATION OF MATERIAL MODIFIERS

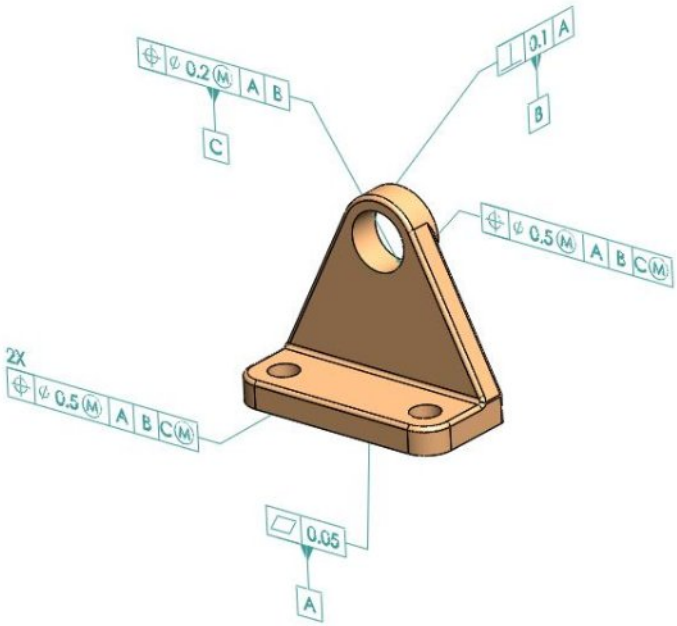
Topic

Regardless of Feature Size (RFS)

Maximum Material Condition (MMC)

Least Material Condition (LMC)

Sub-Topics



Application

(1) To the tolerance feature

(2) To datum's

(1) When applicable

(a) To geometric tolerances

(b) To datum's

(4) zero tolerance at MMC

(2) Results of datum features modified

(a) RFS (implied)

(b) MMC

(c) LMC

(3) Results of pattern of features modified

(a) RFS (implied)

(b) MMC

(c) LMC

(4) Simultaneous requirements

Applicability of RFS, MMC and LMC

- Appropriate applications
- All applicable geometric tolerances
- (Rule #2)
- Alternate practice for position control
- Effect of RFS
- Effect of MMC
- Effect of zero tolerance at MMC
- Effect of LMC
- Effect of zero tolerance at LMC

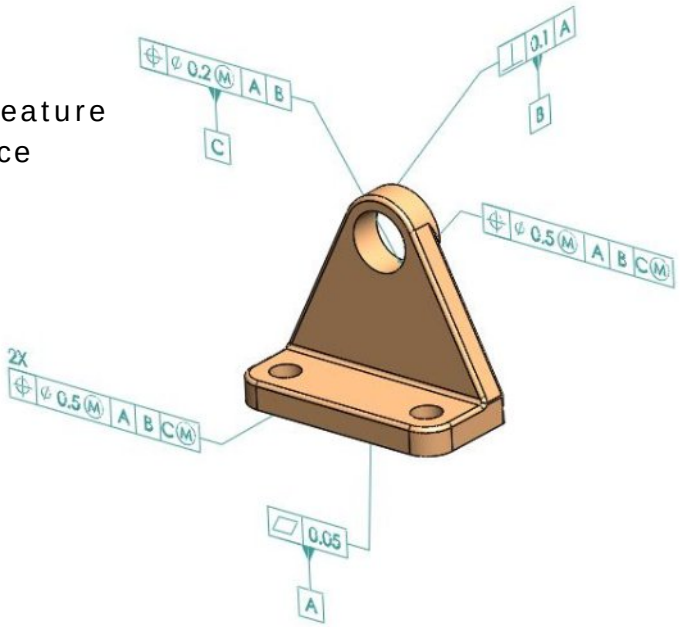
GEOMETRICAL TOLERANCE & TOLERANCE CALCULATION

Tolerances of Location

(1) Utilization of modifiers

1. Effects of RFS (implied)
2. Effects of MMC
3. Effects of LMC

- Displacement allowed by datum features at MMC
- Calculating positional tolerance
- Zero positional tolerance at MMC
- Simultaneous requirements
- Separate requirements
- Projected tolerance zone
- Nonparallel holes
- Counter bored holes
- Closer control at one end of a feature
- Bidirectional positional tolerance
- Noncircular features
- Coaxial controls
- Concentricity (15)
  symmetry



(2) Form

(1) Straightness

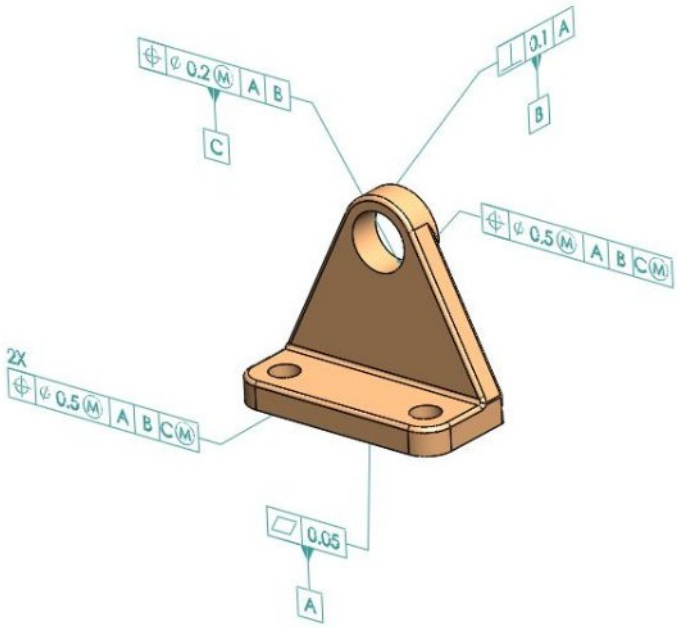
(a) Surface

(b) Axis

(c) Center plane

(d) Applied on a unit basis

(2) Flatness



(a) Surface

(b) Applied on a unit basis

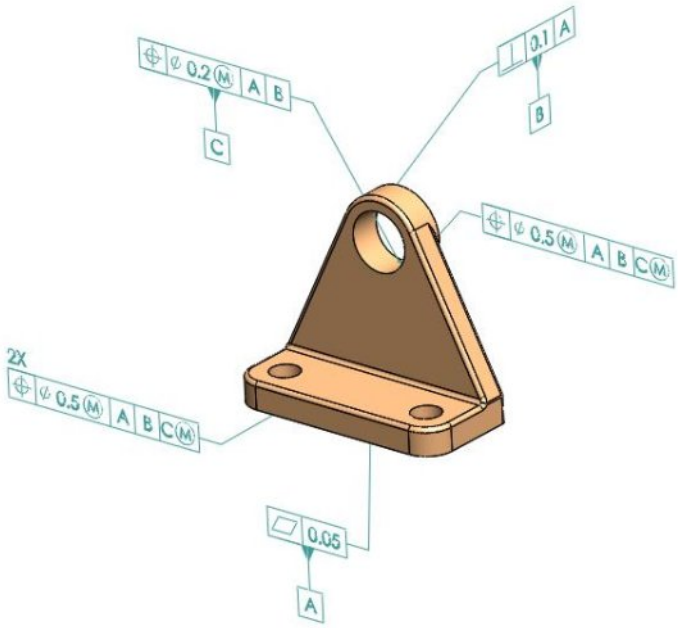
(3) Circularity

(4) Cylindricity

(3) Profile

- Profile of a line
- Profile of a surface
- coplanarity
- For plane surfaces
- On conical features
- Profile of a Surface
  New Symbol for Unequal or Unilateral Profile Tolerancing
  Profile of a Line
  The Power and Versatility of Profile (Mating Parts)
  Tolerancing Mating Part Profiles
  Composite Profile
  Composite vs. Two Single Segment Profile Controls
  Profiling Patterns of Features
  Using 3 Levels of Profile Tolerances
  Coplanarity
  Continuous Feature of Size Symbol
  Dimension Origin Symbol
  Locating Offset Surface with Profile of a Surface
  Conicit

(4) Orientation Tolerances



(1) Angularity

(a) Of a surface

(b) Applied to features of size

(2) Parallelism

(a) Of a surface

(b) Applied to features of size

(3) Perpendicularity

(a) Of a surface

(b) Applied to features of size

(5) Runout Tolerances

1. Single Runout
2. Total Runout

Total Projects in this Course: 40

Total Tolerance Stackup Projects: 40

Solving Blue-Print Drawings: 300