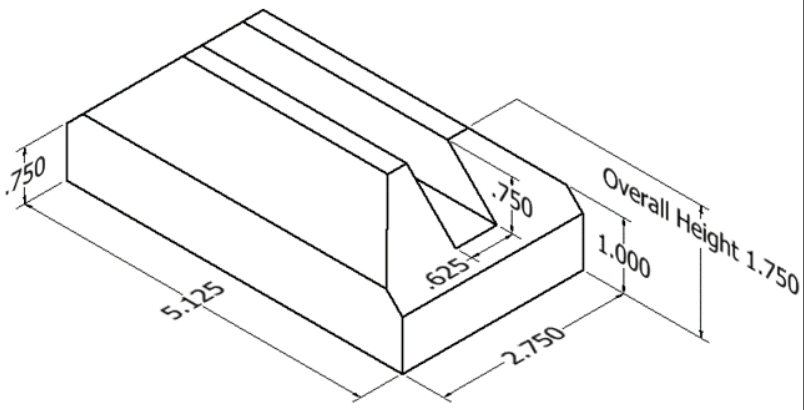
W10: CIM 2.1.2 Mass Analysis

Portfolio Link:
https://m-jeide.github.io/eng-portfolio/CIM/%5BW10%5D%20CIM%202.1.2%20Mass%20Analysis

Procedure

1. Answer the following questions using model 1.

Model	Properties
Model 1 – Slotted Angle Block  Note: 1) Overall Height = 1.75 2) All Chamfers are 45° 3) Slot is Centered on Part	Model Material: • Mild Steel (Steel, Mild) Material Properties • Density: 0.284 lbmass / in^3 • Mass: 5.121 lbmass • Volume: 18.059 in^3 • Surface Area: 52.081 in^2

a. What is the material cost of the part assuming that the cuttings are remelted and the cost of mild steel is $6.25 per pound? What is the material cost of the part assuming that the cuttings are not remelted?

Melted:

$\$6.25/lbmass \ * \ 5.211 \ lbmass \ = \sim\$32.57$

Not Melted:

$5.125in \ * \ 2.750in \ * \ 1.750in \ = \ 24.664in^3$ (calculation of the volume of stock)

$24.664in^3 * 0.284lbmass/in^3 = 7.005lbmass$ (calculation of the mass of the stock)

$\$6.25/lbmass \ * \ 7.005lbmass \ = \sim\$43.78$

b. What is the mass of the material lost in a typical machining process?

The mass of material lost in a typical machining process is not a fixed number; it depends on the Material Removal Rate (MRR). To calculate the material lost, you could use the following formula for any workpiece:

$material\ lost \ = \ volume\ lost \ * \ density\ of\ material$

For this particular model, it would be:

$volume\ lost \ = \ 24.664in^3 \ - \ 18.059in^3 = 6.605in^3$

$material\ lost \ = \ 6.605in^3 * 0.284lbmass/in^3 \ = \sim 1.876lbmass$

c. What is the cost of the lost material based on your calculations above?

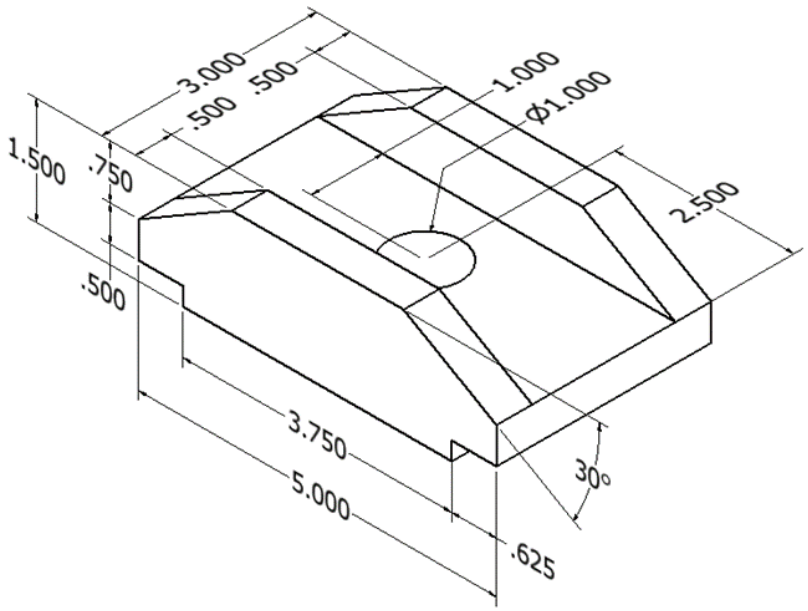
$cost\ of\ lost\ matertial \ = \ 1.876lbmass \ * \ \$6.25/lbmass \ = \ \sim\$11.72$

d. What will the volume of the box (in cubic feet) need to be in order to ship 1000 parts packed without spacers?

$18.054in^3 * 1000 = 18,054in^3 = 10.447ft^3$

e. What other processes could be used to create the same part?

Casting could be used for an effective batch production of this part if we didn't use subtractive manufacturing.

Model	Properties
Model 2 – Mounting Bracket 	Model Material: Stainless Steel Material Properties Density: $.289\ lbmass/in^3$ Mass: $3.342\ lbmass$ Volume: $11.562in^3$ Surface Area: $53.04in^2$

2. Answer the following questions using model 2

   a. What is the mass of the material lost in a typical machining process?

$material\ lost\ =\ volume\ lost\ *\ density\ of\ material$

$material\ lost\ =\ (5.000in\ *\ 3.000in\ *\ 1.500in\ -\ 11.562in^3)\ *\ .289lbmass/in^3\ =\ 3.161lbmass$

   b. What is the cost of the lost material based on your calculations above if the cost of stainless steel is $15.75 per pound?

$cost\ of\ lost\ material\ =\ 3.161lbmass\ *\ \$15.75/lbmass\ =\ \sim\$49.79$

   c. What is the material cost of the part assuming that the cuttings are remelted? What is the material cost of the part assuming that the cuttings are not remelted?

Remelted: $\$15.75/lbmass\ *\ 3.342lbmass\ =\ \$52.637$

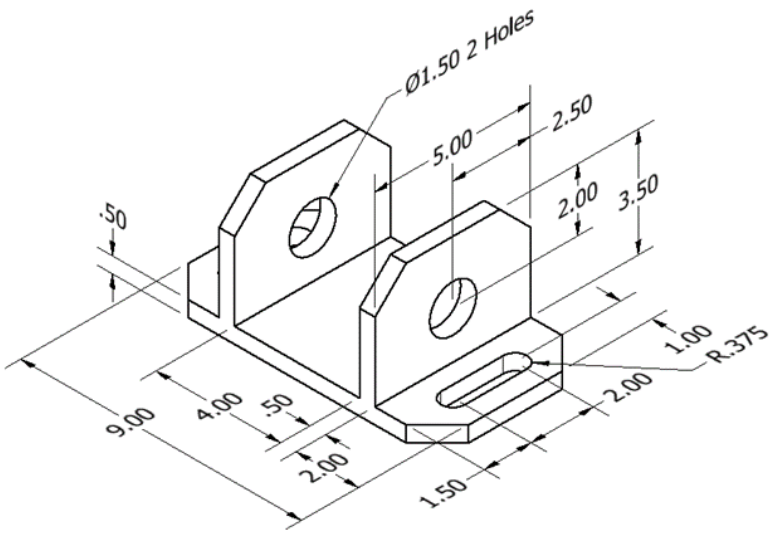
Not remelted: $\$15.75/lbmass\ *\ (5.000in\ *\ 3.000in\ *\ 1.500in\ *\ .289lbmass/in^3)\ =\ \sim\$102.41$

   d. What is the cost to ship 1000 parts if current shipping costs are $3.75 per pound?

$3.342lbmass * \$3.75/lbmass * 1000 = \$12,532.50$

e. What other processes could be used to create the same part?

Casting.

Model	Properties
Model 3 – Support Bracket  Notes: Chamfers are 1" by 1" Typical Slots on both sides	Model Material: Aluminum 6061 Material Properties Density: $0.098lbmass/in^3$ Mass: $3.104lbmass$ Volume: $31.82in^3$ Surface Area: $156.023in^2$

3. Answer the following questions using model 3.

a. What is the material cost of the part assuming that the cuttings are remelted and the cost of aluminum 6061 is $0.62 per pound? What is the material cost of the part assuming that the cuttings are not remelted?

Remelted: $\$0.62/lbmass * 3.104lbmass = \$1.92$

Not remelted: $\$0.62/lbmass * (9.00in * 5.00in * 3.50in * 0.098lbmass/in^3 = \sim\$9.57$

b. What is the mass of the material lost in a typical machining process?

$material\ lost\ =\ (9.00in\ *\ 5.00in\ *\ 3.50in\ -\ 31.82in^3)\ *\ 0.098lbmass/in^3\ =\ 12.316lbmass$

c. What is the cost of the lost material based on your calculations above?

$12.316lbmass\ *\ \$0.62/lbmass\ =\ \$7.636$

d. How many parts can be painted with one gallon of paint that covers 400 ft2?

$156.023in^2\ *\ 1ft^2/144in^2\ =\ 1.0384ft^2$

$400ft^2/1.0384ft^2\ =\ 385.21$

e. What other processes could be used to create the same part?

Casting.