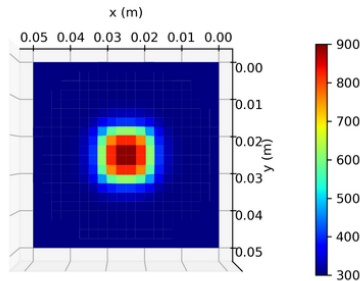


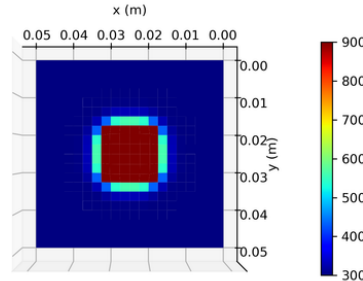
LASER HEATING SIMULATION

Final Temperature Profile of Block Top Plane



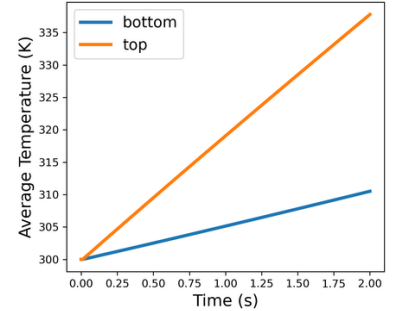
Material A (high K)

Final Temperature Profile of Block Top Plane



Material B (low K)

Avg. Temperatures of Top and Bottom Plane



What?

- Developed 3D transient heat transfer solver to model and simulate laser heating of a 3D cubic block
- Predict temperature distribution to understand material response and guide process parameters

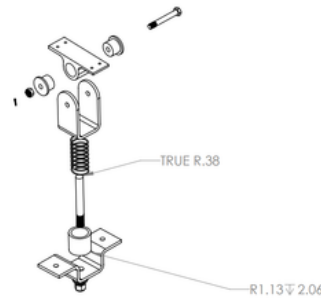
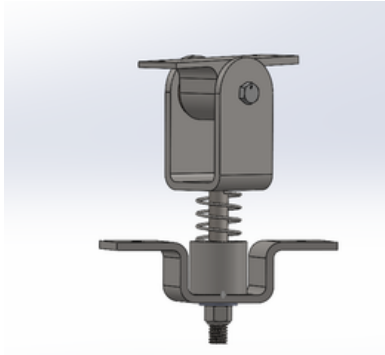
How?

- Modeled laser penetration using Beer-Lambert law
- Built vectorized 3D transient heat transfer solver using sparse matrix operators
- Implemented mask arrays to simulate region-specific thermal boundary conditions (heat sink, insulation, laser input)

Results

- Lower conductivity and heat capacity materials preserved thermal resolution
- Surface temperature increased much faster than surroundings
- Demonstrated relationship between material properties and thermal distribution
- Supports selection of laser and material parameters to control feature sharpness

SHOCK ABSORBER ASSEMBLY



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	U-support	AISI 1020	1
2	Shaft	AISI 1020 CRS	1
3	Pivot	AISI 1020	1
4	Bracket	AISI 1020	1
5	Bushing	Manganese Bronze	2
6	Washer	1.50 x 7.50 x 1.25	1
7	Spacer	AISI 1020	1
8	Locknut	AISI 1020	1
9	Castle Nut	AISI 1020	1
10	Spring	Plain Carbon Steel	1
11	Hex Head Screw	-	1
12	Cotter Pin	Plain Carbon Steel	1

What?

- Designed various parts needed for a shock absorber
- Created a shock absorber assembly in SolidWorks

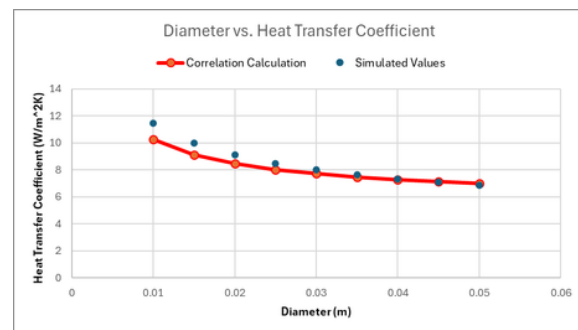
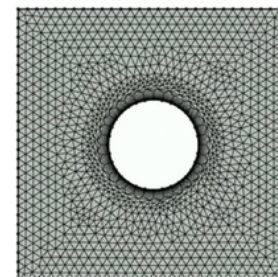
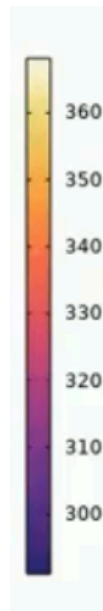
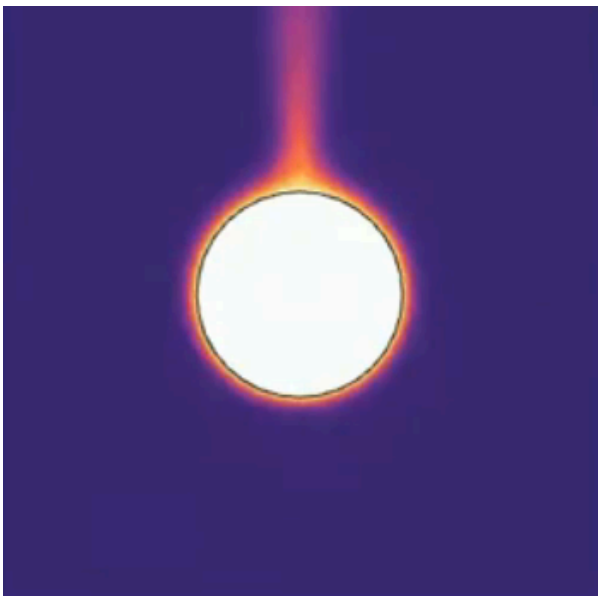
How?

- Created digital drawings for each part
- Connected parts using SolidWorks assembly
- Created bill of materials for all parts used in assembly

Results

- Final shock absorber assembly composed of all necessary parts
- Assembly had realistic movement for a shock absorber
- Verified motion and clearances to reduce potential prototyping iterations

NATURAL CONVECTION SIMULATION



What?

- Simulated 2D natural convection around an isothermal horizontal cylinder heated to 95 deg C
- Compared heat transfer coefficient found from COMSOL with results from theory to understand accuracy

How?

- Created 2D isothermal laminar flow study for heated cylinder with 1-5 cm diameter
- Added boundary layer mesh to resolve steep velocity and temperature gradients at the wall
- Created MATLAB script to calculate heat transfer coefficient from theory

Results

- Validated simulation against analytical heat transfer correlations
- Results converged as diameter increased
- Accurate simulation that can be used for real thermal design decisions