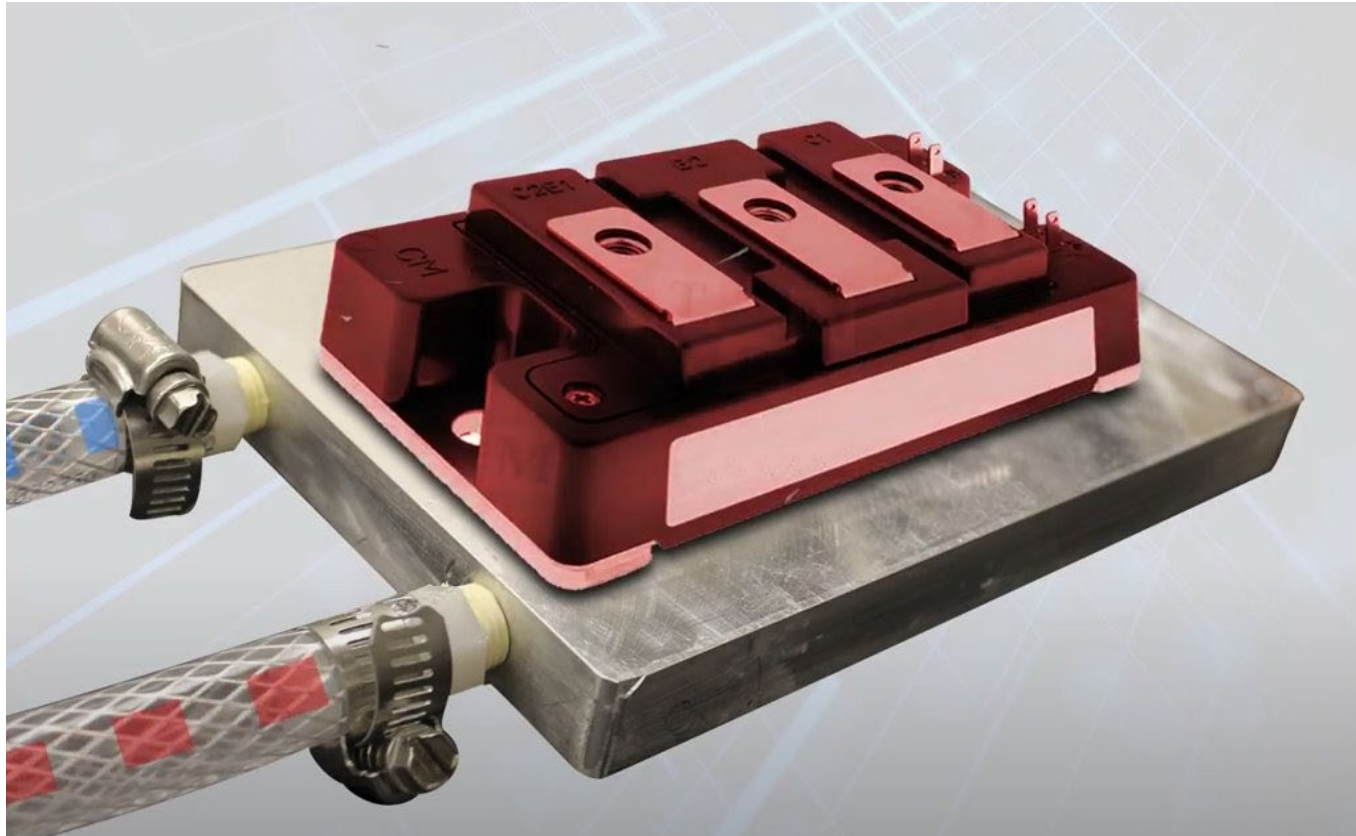


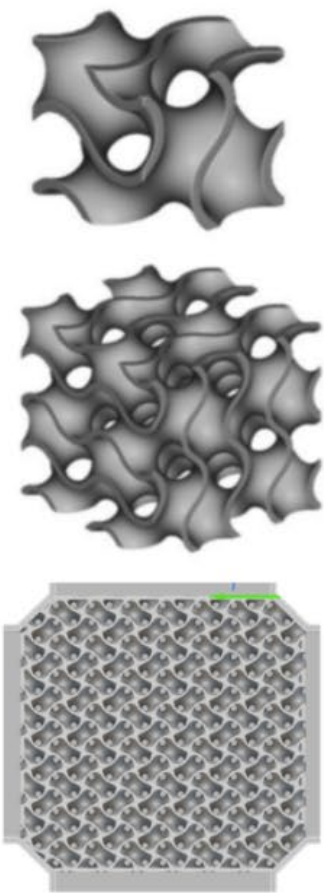
Additively Manufactured (AM) Cold Plate

Project Description:

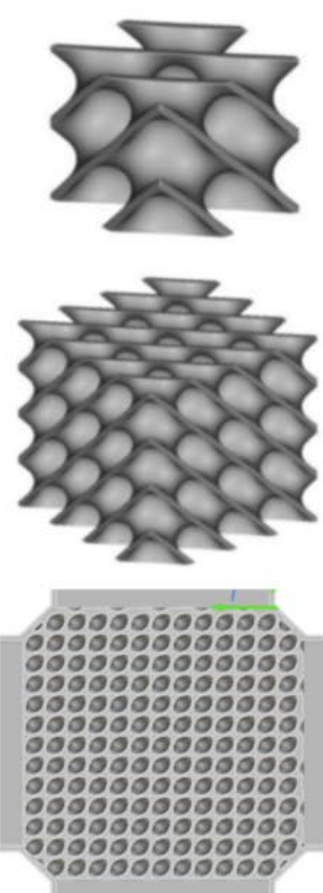
The objective for this project is to investigate , analyze, procure and test AM cold plate design(s) which are representative of designs under consideration for use in high heat dissipating electronic module assemblies in LM designs. This year project is the continuation of "22-23" Additively Manufactured Cold Plate project. The work by last year will be further analyzed to develop a the most optimized design.



Design Options/Possible Solutions:



Design Options		
Traditional	Design Option 1	Design Option 2
Enhance heat transfer process	High surface area to volume ratio	High surface area to volume ratio
Maintain consistent conditions for precise thermal management	More efficient flow, higher heat dissipation	Easier to manufacture, less uniform flow
Custom designs to meet needs of specific applications	Good strength while maintaining flexibility	Repetitive cell structure provides enhanced strength/durability
Easier to design and produce by traditional methods without additive manufacturing	Ideal for fluid efficiency and thermal reduction when smooth uniform cooling is essential	Preferred when mechanical strength and ease of manufacturing are more important with slightly less optimized thermal properties



	Material Type	Thermal Conductivity (W/m*K)	Cost (\$/kg)	Tensile Strength (MPa)
Aluminum	AlSi10Mg	130	140-200	330-430
	7075 Al	130	80-150	570-635
	AlSi7Mg	160	50-120	250-300
Copper	CuSn10	59	190	320
	Pure Cu	400	189	380
	CuCrZr	200	190	320

Continuity:

$$\frac{\partial \rho}{\partial t} + \nabla \cdot (\rho \mathbf{V}) = 0 \tag{1}$$

x-momentum:

$$\frac{\partial (\rho u)}{\partial t} + \nabla \cdot (\rho u \mathbf{V}) = -\frac{\partial p}{\partial x} + \nabla \cdot (\mu \nabla u) + S_{Mx} \tag{2}$$

y-momentum:

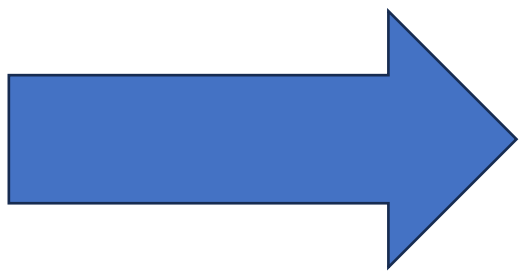
$$\frac{\partial (\rho v)}{\partial t} + \nabla \cdot (\rho v \mathbf{V}) = -\frac{\partial p}{\partial y} + \nabla \cdot (\mu \nabla v) + S_{My} \tag{3}$$

z-momentum:

$$\frac{\partial (\rho w)}{\partial t} + \nabla \cdot (\rho w \mathbf{V}) = -\frac{\partial p}{\partial z} + \nabla \cdot (\mu \nabla w) + S_{Mz} \tag{4}$$

Energy:

$$\frac{\partial (\rho e)}{\partial t} + \nabla \cdot (\rho e \mathbf{V}) = -p \nabla \cdot \mathbf{V} + \nabla \cdot (k \nabla T) + \Phi + S_e \tag{5}$$



Current progress:

- Creo experience: Downloaded Creo software and are utilizing tutorials to become more proficient in its application
- Ansys Fluid experience: Utilizing Ansys Innovation Courses to gain exposure to all features Ansys has to offer, including Ansys Fluent
- Product research: Intensive research on cold-plate design, manufacturing, and installation processes
- Aluminum & Copper alloy research and data gathering

Semester Deliverables:

1. Develop more robust process for translating Creo model geometry into Ansys in preparation of CFD/CHT modeling
2. Document repeatable process for transferring files from Creo to Ansys
3. Conduct analysis of cold plate design
4. Develop algorithms and/or techniques to maximize analytical efficiency
5. Offer potential design improvement options



Professor Sarimurat



Mykhaylo Rafalaskyy



Gabriel O'Connor



Kaixi Gu



Justin Sauve