Toward compact, high-performance cryogenic heat recuperators by exploring a new and unexploited flow phenomenon in wavy channels

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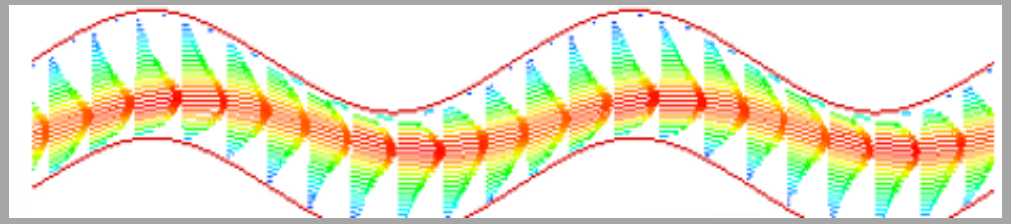
Research Objectives

-Study the potential of a new flow phenomenon in reducing the SWaP of the SOA recuperators

-Starts at TRL 1 (basic principle of the novel flow phenomenon through wavy channels is observed)

-Ends at TRL 3 (feasibility will be proved for recuperators using analytical, numerical, and experimental proof-of-concept studies)



For optimized wavy channels, the fluid moves closer to the crests of the wavy walls, which enhances the heat transfer performance without increasing the heat exchanger size, while simultaneously controlling the pressure drop increase (no turbulence)

Technical Approach

Scientific study of a new flow phenomenon in wavy channels and use the findings of the study to optimize proof-of-concept designs for 90 K and 20 K cryogenic recuperator channels by employing: computational and analytical modeling, advanced manufacturing, and performance testing in the PI's laboratory

Potential Impact

Enhancing heat transfer without increasing the size or reducing the size for the same heat transfer performance will enhance the capability of thermal management systems for spacecraft electronics and propellants and enables long-duration space missions. Success of this project has the potential to reduce the size and weight of future cryocoolers by >2x.