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## **SESSION 13: Cryocooler Analysis & Modeling Techniques**

**Paper No. 13-6 Thursday Afternoon 3:00 PM**

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### ***Design, Optimization and CFD Analysis of a Split Type Free Piston Stirling Cooler for Onboard Applications***

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A Stirling cryocooler is a device that is working on a closed thermodynamic cycle, which is used for producing the cooling effect. These Stirling coolers are capable of producing a cooling effect that ranges from milliwatts to watts according to the need. The main applications of these Stirling cryocoolers are for cooling the Infrared sensors in Satellites. A free-piston Stirling cooler is a type of Stirling cooler in which the power piston is operated with the help of a linear motor. In the initial part of this study, a novel moving magnet type split free-piston Stirling cryocooler of 0.5 W cooling capacity is designed and optimized with the help of SAGE 11 software. It produces a Carnot efficiency of 0.14303 %. Then the effect of various input and geometric parameters were analysed with the help of SAGE 11 software. In the second part of the study, a 2-D model of the split type free-piston Stirling cryocooler has been done. Then the CFD analysis of the split type free-piston Stirling cooler has been done. The dynamic mesh approach is used for incorporating the back-and-forth linear motion of the piston and the displacer. The main results obtained after the simulations are presented in tabular and graphical forms in this paper.