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ACCEPTED MANUSCRIPT

Title: Determination of the temperature vs power dynamic behavior of a cryocooler via two independent methods in time and frequency domain.

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Graphical abstract



Abstract: This report deals with the analysis of a cryocooler as a linear dynamical system around a set point, over a range of temperatures where the thermal properties can be considered constant. The accurate knowledge of the cryocooler temperature dependence with a time dependent power stimulus allows to analyze the thermodynamical properties of the system and understand the power flow related, for example, to the cryocooler temperature fluctuations. This is useful for the design of efficient thermal dampers that are necessary for the thermal stabilization of the device under test [1] [2]. Two different and independent methods for deriving the cooler dynamic (i.e. non-stationary) behavior are described using the two main approaches to mathematically represent a dynamical system: step response and transfer function.

- Using both approaches we were able to cross check results and provide an estimate of the accuracy of each method.
- The instrumentation required is typically available in physics and engineering laboratories.
- These results provide insights on cryocooler thermodynamics and design tools for cryocooler engineering

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