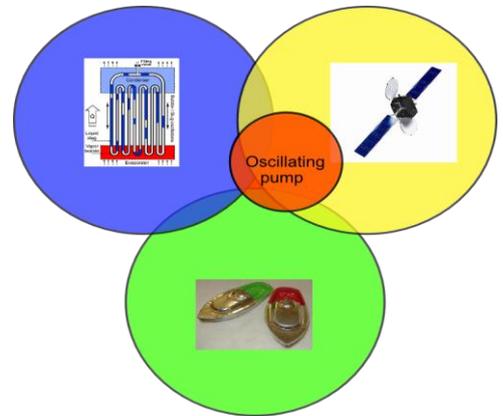


Research theme Thermal energy
Research title Design of a self-oscillating pump driven by thermal energy
Researcher Mark Slomp
Research period April 2012 - February 2013
Company University of Twente and NLR
Supervisor Wessel Wits



Research at the crossroad of several fields

Background

The research is done in cooperation with the NLR, the Dutch aviation and aerospace research centre, and the University of Twente.

Assignment

The development of the Self-Oscillating Pump (SOP) is initiated by the growing demand for cooling performance in aerospace equipment. The goal of the research is to develop a pump with another working principle than the now common used pumps in harsh environments and applications, such as aerospace applications.

The goal of this research is to construct a proof of principle prototype of a heat driven self-oscillating pump. Also a experimentally validated numerical model is developed. This model must be able to describe the oscillating mass displacement of the prototype such that a conclusion can be drawn about the feasibilities of applying the self-oscillating pump as a reliable pump in aerospace cooling applications.

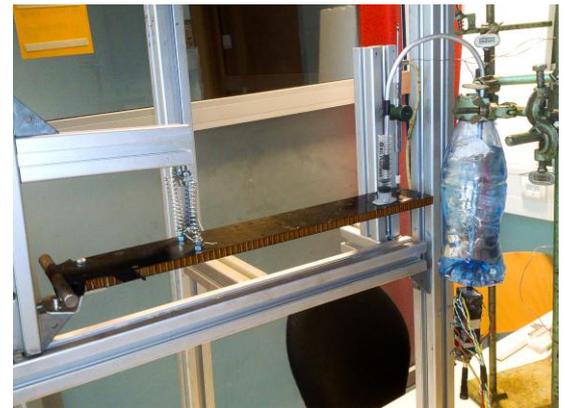
Results

The numerical model is capable of simulating the mass flow obtained from the prototype SOP. The difference between the simulation mass flow and the experimental mass flow is for the executed experiments between -5% and 5%.

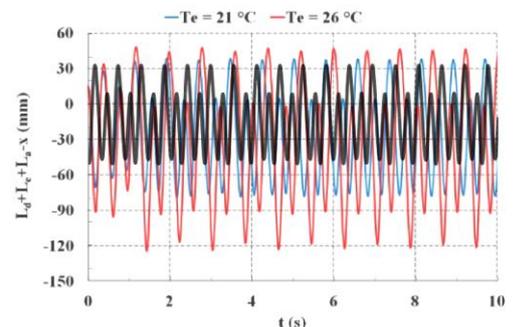
The SOP is a promising device for pumping fluid in challenging environments or markets, i.e. aerospace, where simplicity and reliability is important or thermal waste energy is available to use as energy supply for a heat driven self-oscillating pump. The pump developed in this research is a low cost, reliable and innovative pump and suitable for challenging environments.

Personal experience

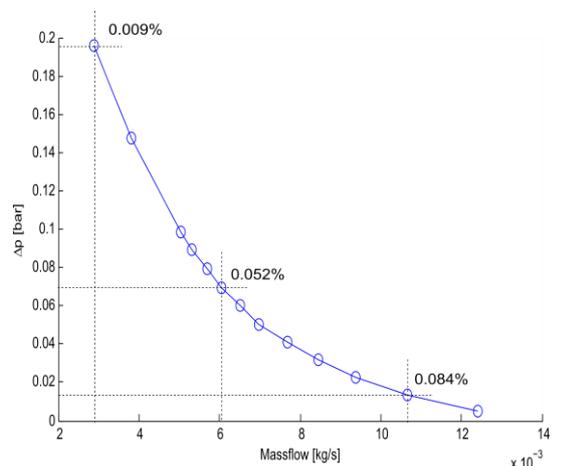
I was not really looking for a thermal based assignment and I don't have any thermal courses in my master program at all. However, it was very interesting to obtain required the knowledge 'on the flow' of the project. Most interesting of the research is the overlap between the different fields of mechanical engineering. The design of the pump was a interplay between simulations and experimental work. I had to obtain and apply specific knowledge about thermo-dynamics, vibrations and solving complex systems of ODE's.



Prototype



Numerical results



Pump curve