Public Abstract
First Name:Wei
Middle Name:
Last Name:Shao
Adviser's First Name:Yuwen
Adviser's Last Name:Zhang
Co-Adviser's First Name:
Co-Adviser's Last Name:
Graduation Term:SP 2010
Department:Mechanical & Aerospace Engineering
Degree:MS
Title:ANALYSIS OF OSCILLATORY FLOW AND HEAT TRANSFER
IN AN OSCILLATING HEAT PIPE

An advanced physical and theoretical model of a U-shaped minichannel - a building block of an Oscillating Heat Pipe (OHP) - has been developed step by step.
a) The gravity and pressure loss at the bend are included in the momentum equation of the liquid slug. The sensible heat transfer coefficient between the liquid slug and the minichannel wall are obtained by analytical solution for laminar liquid flow and by empirical correlations for turbulent liquid flow. Besides, the effect of axial step variation of surface temperature is considered by using method of superposition to calculate the sensible heat transfer coefficients between the liquid slug and the minichannel wall in laminar region. The evaporation and condensation heat transfer coefficients are simply assumed. The role of axial variation of surface temperature is mainly on the liquid flow dominated by laminar region and the pressure loss at the bend delays the phase of oscillation.
b) Capillary force and inclination angle are added into the momentum equation of the liquid slug to investigate the surface tension and gravity effects on the oscillatory flow and heat transfer in an OHP with different inner diameters and orientations. The results show that gravity effect hinders the performance of top heat mode OHP while aids the operation of bottom heat mode OHP. Comparisons between the cases with surface tension and without surface tension indicate that the effect of surface tension on the performance of OHP is negligible even for small inner diameter.
c) Film evaporation and condensation models are consistently specified to calculate latent heat transfer happened in the evaporator and condenser. Precise prediction of latent heat transfer due to phase change can be given by current heat transfer model.