Addis Ababa University

AAiT

School of Mechanical and Industrial Engineering

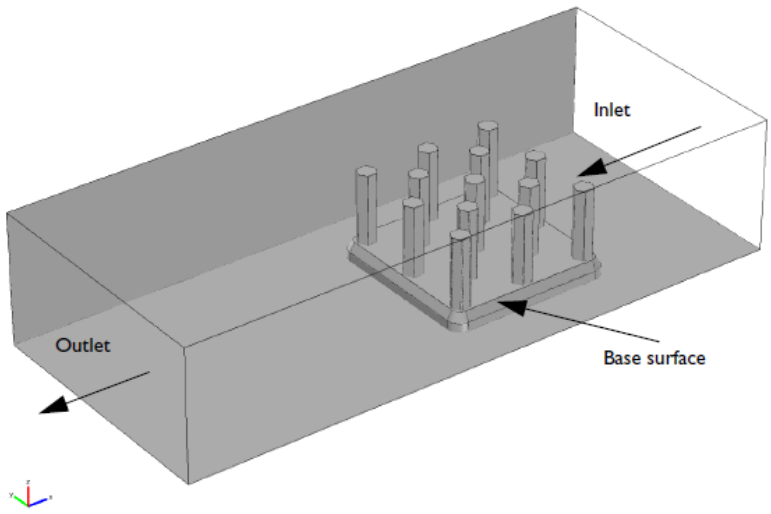
Computational Heat transfer

Project 4

Use Fluent to compute the following problem, temperature and velocity filed are the main parameters to be computed.

Problem statement

The following system consists of an aluminum heat sink for cooling of components in electronic circuits mounted inside a channel of rectangular cross section (see Figure). Such a set-up is used to measure the cooling capacity of heat sinks. Air enters the channel at the inlet and exits the channel at the outlet. The base surface of the heat sink receives a 1.5 W heat flux from an external heat source. All other external faces are thermally insulated.



The cooling capacity of the heat sink can be determined by monitoring the temperature of the base surface of the heat sink. The model solves a thermal balance for the heat sink and the air flowing in the rectangular channel. Thermal energy is transported through conduction in the aluminum heat sink and through conduction and convection in the cooling air, this effect labels a conjugate heat transfer phenomena. The temperature field is continuous across the internal surfaces between the heat sink and the air in the channel. The temperature is set at the inlet of the channel. The base of the heat sink receives a 1.5 W heat flux. The transport of thermal energy at the outlet is dominated by convection. The flow field is obtained by solving one momentum balance for each space coordinate (x, y, and z) and a mass balance. The inlet velocity is defined by a parabolic velocity profile for fully developed laminar flow. At the outlet, the normal stress is equal the outlet pressure and the tangential stress is canceled. At all solid surfaces, the velocity is set to zero in all three spatial directions. The thermal conductivity of air, the heat capacity of air, and the air density are all temperature-dependent material properties.

Property Name Value Unit Property

Name	Value	Description
U*o*	0.05000 m/s	Mean inlet velocity
T_0	293.2 K	Inlet temperature
P_{tot}	1.5 W	Total power dissipated by the electronics package
K	2[W/(m•K)]	Thermal Conductivity

Name	**Dimension[cm]**	**Description**
L_Channel	7	Channel length
W_Channel	3	Channel width
H_Channel	1.5	Channel height
L_Chip	1.5	Chip size
H_Chip	2mm	Chip height

Location of the **Position** section for the chip.

- In the **xw** text field, type `-45[mm]`.
- In the **yw** text field, type `-W_channel/2`.

Heat Sink geometry- use the following and adopt the geometry in solid work

Base of a heat sink = 0.001m X 0.001m
Thickness = 0.02m
Hegh of the fin 0.1m