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CHT-17: BOUNDARY EFFECT ON THE HEAT TRANSFER COEFFICIENT

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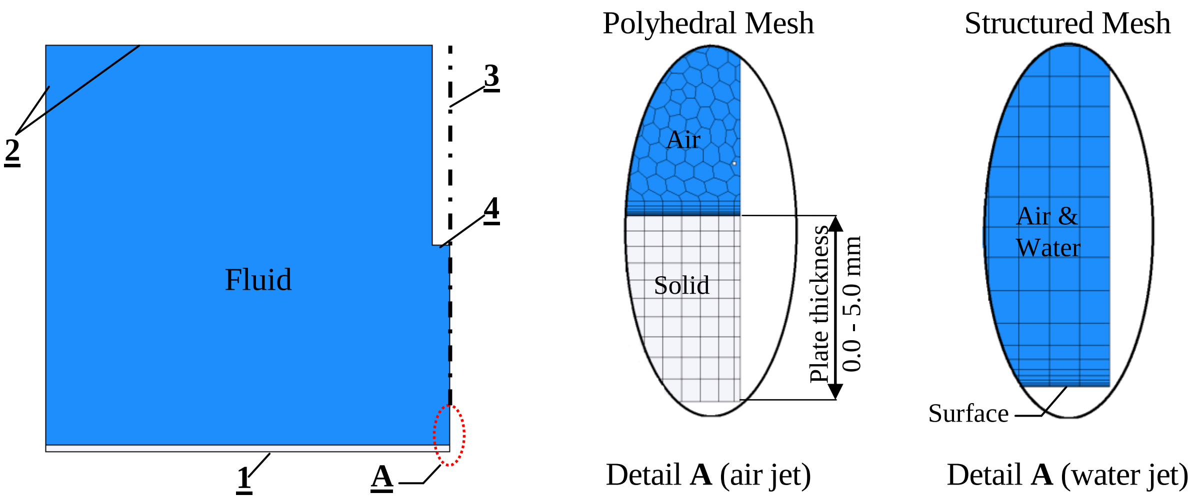
A transient numerical investigation to determine the thermal boundary effect on the normalized local Nusselt number profile due to impinging water and air jets has been carried out in this study. Figure 1 shows the computational domain with relevant boundary conditions. Pipe nozzle sizes of d = 12.5 and 25.0 mm for air and d = 4.0 and 6.0 mm for water, with nozzle-to-target distance h/d = 6 and various bulk velocities, are used in the current study. The validation process was carried out by comparing the computational results using zero plate thickness (no conjugate effect), with experimental data of It is found that the computational model can reproduce the experimental data with a maximum difference of less than 10% (the validation process is not presented here). The maximum value of the non-dimensional wall distance (y^+) at fluid-solid interfaces is less than 3.0 over the entire computational domain for all cases.



1: Constant heat flux; 2: Pressure outlet; 3: Axisymmetry boundary; 4: Nozzle exit

Figure 1. Computational domain with relevant boundary conditions

The surface heat flux has some impact on the Nu/Nu_0 profiles at low Reynolds number when the size of the nozzle is reduced. For the water jet, the effect of the surface heat flux and the nozzle size on the Nu/Nu_0 profiles is insignificant at low Reynolds number; however, it becomes more significant at higher Reynolds number. The effect of the CHT is apparent in this study, the Nu/Nu_0 profiles are influenced by the thermal conductivity of the impingement target (disc). The surface temperature distribution becomes more uniform as the thermal conductivity of the disc increases due to the enhancement of the conductive heat transfer inside the solid.