My current research is on the **Heat Transfer Analysis for Homogeneous Bubble Nucleation during Jet Impingement Quenching**.

Jet impingement quenching is a direct liquid cooling technique with a promise of dealing with high heat flux which may give rise to heterogeneous and / or homogeneous nucleation of bubbles. In the present study, the phenomenon that happens during a brief contact of a liquid jet impinging on a hot solid surface has been analytically investigated.

In liquid analysis, a simple semi-infinite conduction heat transfer model is considered and the heat transfer analysis has been carried out for two different heating conditions, namely with (i) Prescribed Surface Temperature (PST-case) and (ii) Time-dependent Surface Temperature (TST-case). For each of the above cases, explicit equations for temperature distribution within liquid and other parameters have been derived and solved numerically and their outcomes are discussed. Furthermore, the average surface heat flux (q_s) during jet impingement quenching is determined using the concept of critical time (t^*) and compared with the thermodynamic limit of heat flux, which assures the validity of the analytical study. Also the information of the average stored energy and the minimum required energy for bubble formation gives the possibility of homogeneous bubble nucleation during jet impingement quenching. In solid analysis, a two-dimensional cylindrical heat transfer model has been devised and the simulation results are analyzed for a clear understanding of the cooling process of the hot solid surface at the early stages of jet impingement.

It is found that, when sufficient amount of energy is stored in superheated liquid after a particular time of contact of the liquid jet with the hot solid and when this energy becomes greater than the minimum amount of energy required for bubble formation, there is always a possibility for homogeneous bubble nucleation during jet impingement quenching process. As for example, a contact time of 0.025 μs is needed for water in PST case to trigger homogeneous bubble nucleation during such quenching process. From the solid analysis, the present study finds an alternating wet and dry phenomenon at the solid surface at early stages of cooling with a frequency of 16.4 cycles/s. It is also found that a contact period of 0.55 s for steel and 1.1 s for brass is required for a sustainable solid-liquid contact at early stages of jet impingement quenching.