

Infrared Thermography (IRT) of Conjugate Heat Transfer (CHT) Problem and Comparison with Multiphysics Model



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Abstract

This work presents a problem undergoing conjugate heat transfer (CHT). Conjugate heat transfer problems are common in domestic heating/cooling, industrial heat exchangers, cooling of electronics (e.g. PC fans). It is to be noted that in conjugate heat transfer problems, the convection part of the heat transfer is dominated.

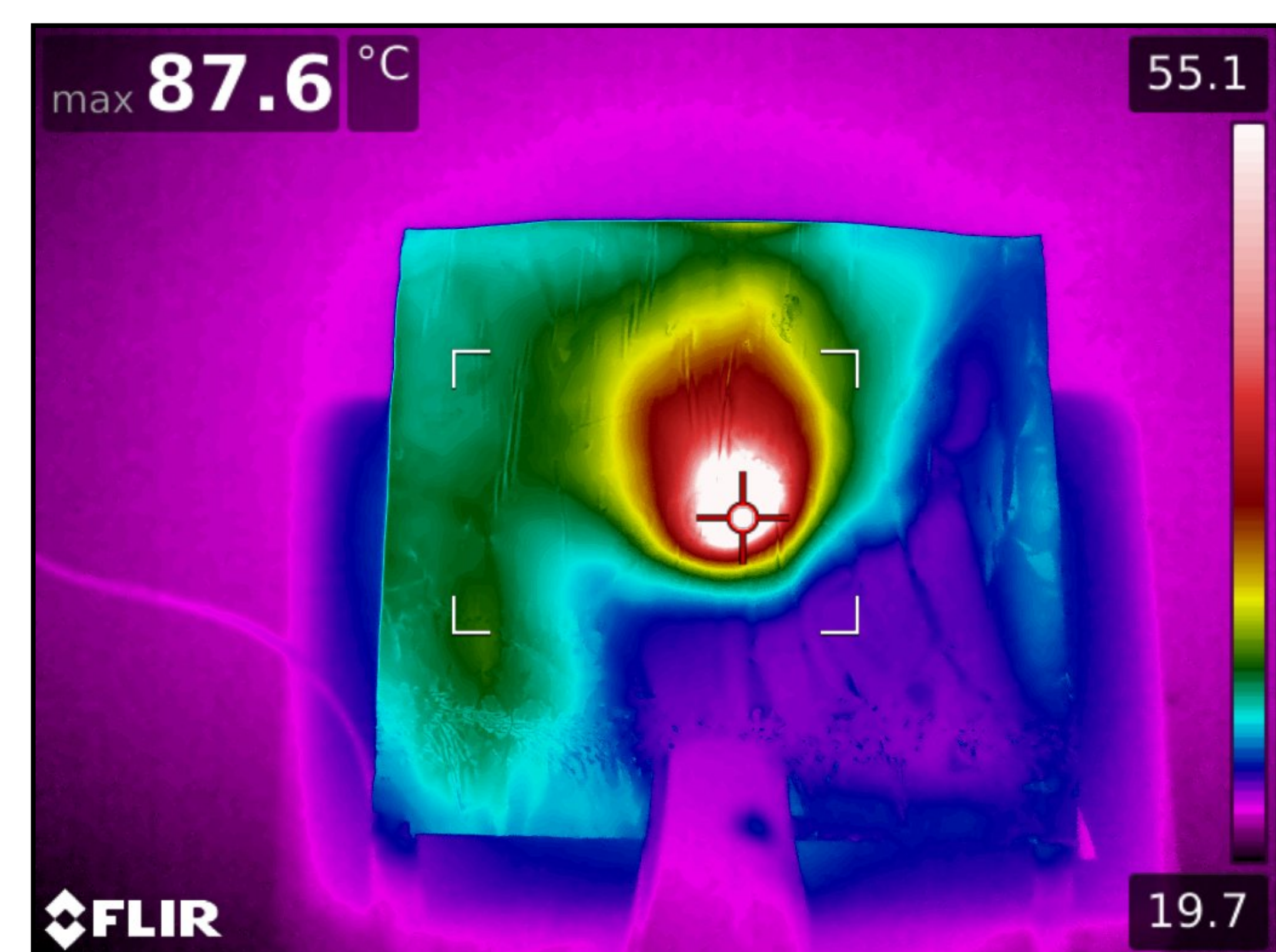
In the given study, a hypothetical case is built where a heat source (a burning candle) is placed under a thin aluminium sheet. The aluminium sheet is exposed to wind velocity using a fan (velocity of ~ 1.75 m/s). The aluminium sheet is coated with acrylic paint to increase the infrared emissivity of the surface. FLIR® T1030sc camera is used to visualise the developed infrared signature. Precautions are taken to ensure the correctness of results. The given problem is simulated using ANSYS® Multiphysics, where fluid mechanics equations; continuity, Navier-Stokes and energy are coupled with the heat equation. This Multiphysics problem is solved using a finite volume method. Mesh sensitivity analysis is performed to ensure the correctness of results.

The results from infrared thermography and the Multiphysics model are compared and found to be in reasonable accuracy.

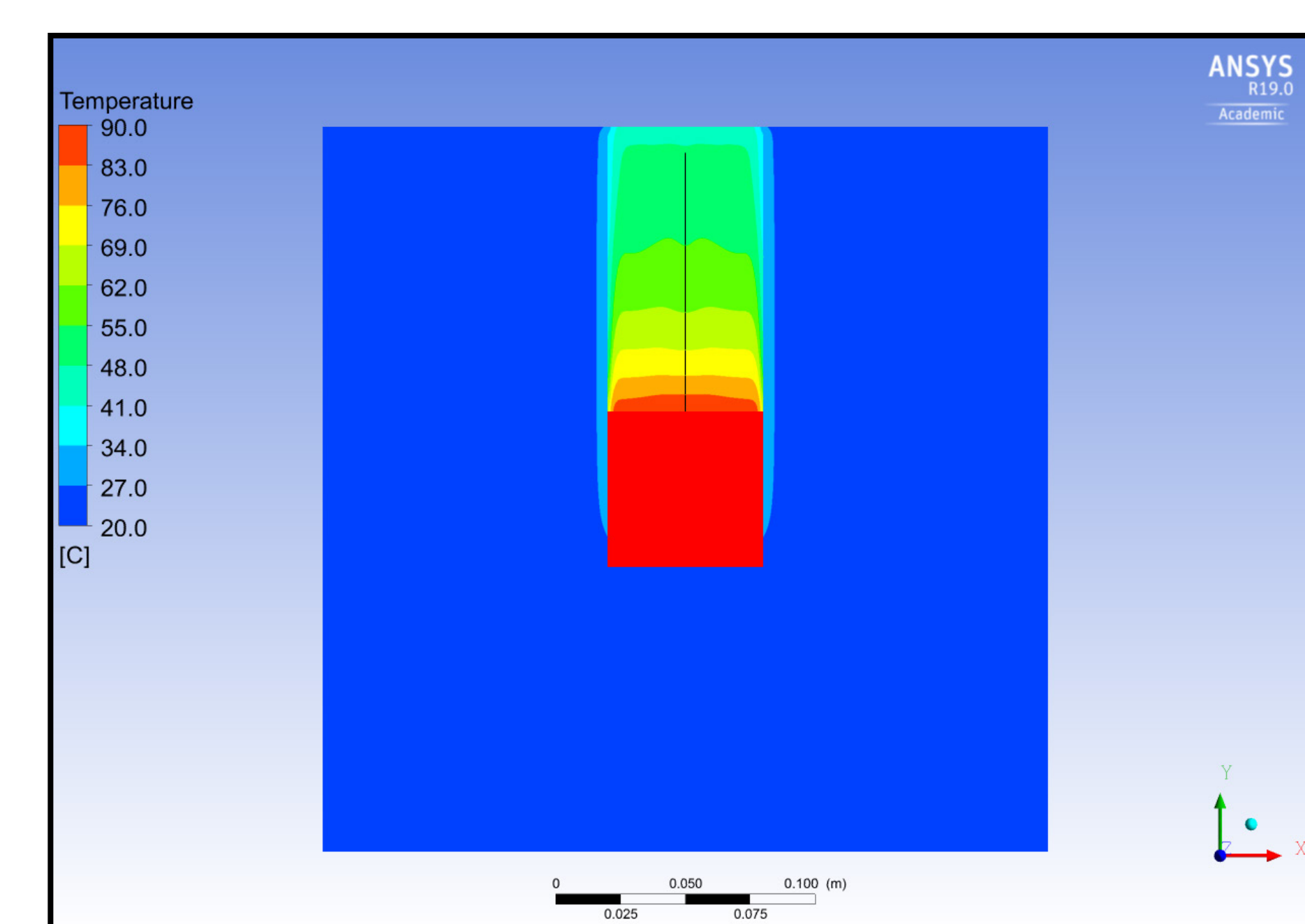
Experimental Setup



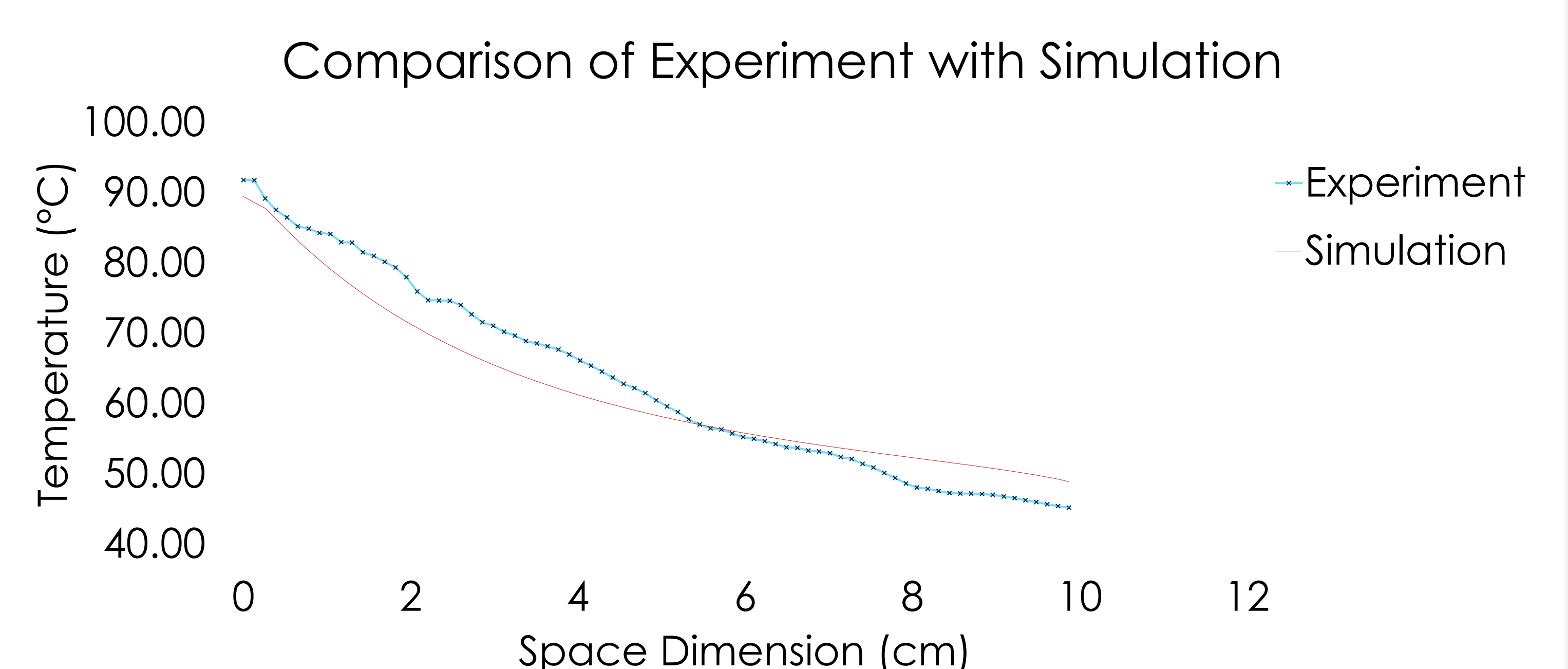
Thermography



CHT Simulations (ANSYS®)



Thermography (Experiment) vs CHT (Simulation)



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