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NUMERICAL AND EXPERIMENTAL STUDY OF HEAT TRANSFER ENHANCEMENT IN BUOYANCY DRIVEN FLOWS ON A VERTICAL HEATED WALL USING VORTEX GENERATORS

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Abstract. This work analyses the cooling process of vertical heated walls due to the air flow induced by buoyancy and the heat exchange enhancement introduced by the use of vortex generators attached to or placed at a certain distance from the wall to be cooled. The analysis is directed towards its application to heat exchangers in panel type radiators of power transformers. In previous research the most convenient configuration to attain the highest thermal enhancement factor was found with thermo-fluid dynamics simulations using the multiphysics code Code_Saturne. It was concluded that separating the vortex generator from the surface of the heated wall has positive effects. The benefits of installing a set of delta-wing vortex generators on the panel were later analyzed, concluding that overall heat transfer improves by a factor of 12% if local heat exchange coefficients are considered. Here, the previous research is extended to different working conditions of the radiators. However, because of the technical difficulties and time required to carry out experimental measurements on a real power transformer, an ad-hoc workbench is devised. This allows to perform measurements in a controlled ambient and to easily adjust test parameters, without risk-operation of high voltage electric currents. Air velocity and temperature measurements are carried out with a hot-wire anemometer while the temperature field on the hot wall is visualized with a thermographic camera and k-type thermocouples are distributed along the heated wall. Comparison between simulations and experimental results are presented and discussed.

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