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C2Or4D-07: Heat transfer characterization of a flat plate liquid cryogenic jet impingement with inverse method

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The use of hydrogen as an energy source to fuel aircraft is one of the alternatives currently being evaluated by Airbus. For this type of application, a liquid hydrogen cryogenic storage is considered and heat transfer phenomena involved by the cooling of a structure by the impingement of cryogenic liquid jet should be understood. To this purpose, the phenomena will be described based on the exploitation of a dedicated experimental campaign, together with a methodology to characterize spatially and temporally the heat flux at the wall. Due to the complexity induced by the use of liquid hydrogen, this work has been done based on the results of a test campaign carried out with liquid nitrogen as a representative cryogenic fluid. An inverse method for nonlinear thermal problems has been used in order to numerically evaluate the heat fluxes at the wall from the plate temperature measurements. The on-set of the different boiling regimes is in agreement with the temperature differences found in literature. The effect of the jet release pressure will also be compared in terms of evolution of wall temperature and respective heat transfer coefficients, also confronted with recent studies available in the literature.

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