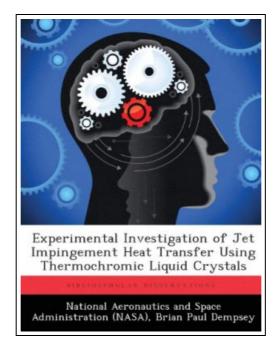
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Biblioscholar, United States, 2013. Paperback. Condition: New. Language: English. Brand New Book ***** Print on Demand ******. Jet impingement cooling of a hypersonic airfoil leading edge is experimentally investigated using thermochromic liquid crystals (TLCS) to measure surface temperature. The experiment uses computer data acquisition with digital imaging of the TLCs to determine heat transfer coefficients during a transient experiment. The data reduction relies on analysis of a coupled transient conduction - convection heat transfer problem that characterizes the experiment. The recovery temperature of the jet is accounted for by running two experiments with different heating rates, thereby generating a second equation that is used to solve for the recovery temperature. The resulting solution requires a complicated numerical iteration that is handled by a computer. Because the computational data reduction method is complex, special attention is paid to error assessment. The error analysis considers random and systematic errors generated by the instrumentation along with errors generated by the approximate nature of the numerical methods. Results of the error analysis show that the experimentally determined heat transfer coefficients are accurate to within 15. The error analysis also shows that the recovery temperature data may be in error by more than 50. The results show that the recovery temperature data is only reliable when the recovery temperature of the jet is greater than 5 C, i.e. the jet velocity is in excess of 100 m/s. Parameters that were investigated include nozzle width, distance from the nozzle exit to the airfoil surface, and jet velocity. Heat transfer data is presented in graphical and tabular forms. An engineering analysis of hypersonic airfoil leading edge cooling is performed using the results from these experiments. Several suggestions for the improvement of the experimental technique are discussed.

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