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Effects of buoyancy on heat transfer under an inclined flat plate MICHAEL GOLLNER, University of Maryland, College Park, ANTONIO SANCHEZ, Universidad Carlos III de Madrid, FORMAN WILLIAMS, University of California, San Diego — A recent study of flame spread over and under a plastic fuel at different angles of inclination revealed new flame-spread behavior, where peak rates of flame spread were found on the underside of fuel surfaces, in contradiction with the traditional assumption that maximum spread rates occur in a vertical configuration (Gollner et al, Proc. Comb. Inst, 2012). Because flame spread is governed by heat transfer from flames to unignited fuel, a natural analogy can be drawn with heat transfer from an inclined, heated flat plate. Kierkus (IJHMT, 1968) performed a first-order perturbation analysis of this problem, however in taking the boussinesq approximation, the lack of density variation within the boundary layer resulted in no differences in the results between the under and over flat plate configurations. In this analysis, an attempt is made to perform a second-order perturbation analysis without invoking the boussinesq approximation, taking into account density differences within the boundary layer. These results are compared to heat-flux measurements made during flame spread both over-and-under inclined fuels to see if this observation is in fact caused by buoyancy effects within the boundary layer.

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