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Experimental and Numerical Study of Marangoni-Natural Convection

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An experimental and numerical study of steady thermal Marangoni-natural convection was carried out to examine the flow behaviour under various conditions of liquid layer depth and heating temperatures. Silicone oil was used as the working fluid in a cylindrical glass container heated on its free surface in the centre. To minimize natural convection effects and to allow Marangoni convection to dominate, layer depths in the order of milimetres was studied. Particle Image Velocimetry (PIV) was used to visualize the flow both qualitatively and quantitatively. FLUENT V6 was used to create a numerical model to provide comparison with the experiment. The numerical model assumes the Boussinesq approximation with steady, axisymmetric, laminar flow. The agreement between the experimental and numerical results is good. The liquid free surface shape due to the presence of menisci is shown to be important in the validation of the results.

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