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Laser-Induced Fluorescence, Particle Tracking Velocimetry And Infrared Thermography For The Investigation Of Spatiotemporally Resolved Heat-Transfer In Thin Liquid-Film Flows[1] CHRISTOS MARKIDES, ALEXANDROS CHAROGIANNIS, Imperial College London — Laser-induced fluorescence (LIF), particle tracking velocimetry (PTV) and infrared thermography (IRT) are employed towards the detailed study of the hydrodynamic characteristics and heat-transfer performance of harmonically-excited film-flows falling over a resistively heated glass-substrate. PLIF is used to recover space- and time-resolved film-heights, PTV to obtain velocity data across the flow, and IRT to measure the temperature of the gas-liquid interface. The liquid Kapitza number is set to $Ka = 180$, the Reynolds number is varied in the range $Re = 20 - 75$, the heat-flux at the wall is varied between $\dot{q} = 1.5$ and 3 W cm^{-2}, and the forcing-frequency is varied between $f_{\mathrm{W}} = 7$ and 17 Hz. Complementary data are obtained for the same flow Re and f_{W} under isothermal conditions. Using the IRT data and knowledge of the local solid-liquid interface temperature, we also recover heat transfer coefficients (HTCs), and link those to the hydrodynamics of the examined films. Towards that end, we generate highly localized flow and heat-transfer data along the waves by employment of phase-locked averaging, along with film-height, velocity, flow-rate and HTC time-series.

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