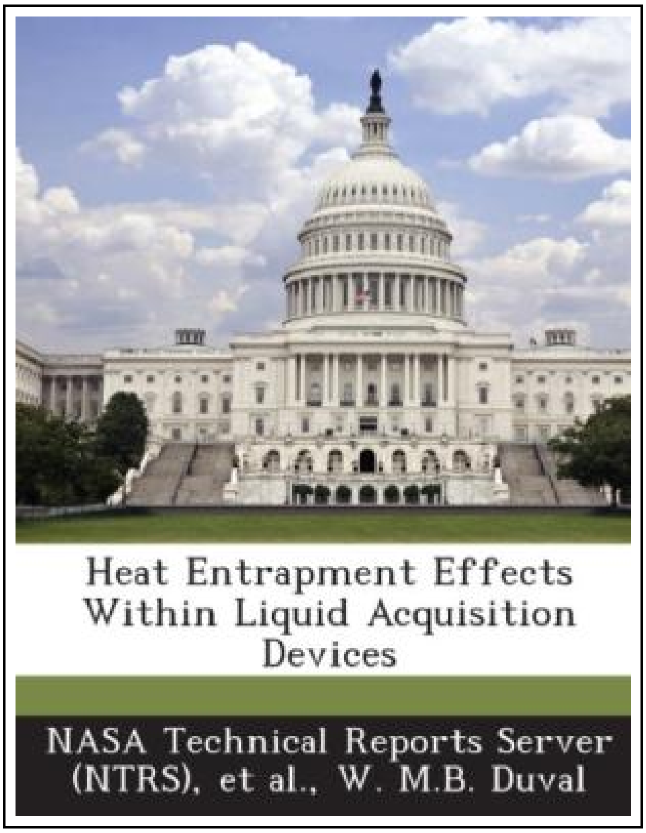
Heat Entrapment Effects Within Liquid Acquisition Devices



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(Ms. Madaline Nienow)

HEAT ENTRAPMENT EFFECTS WITHIN LIQUID ACQUISITION DEVICES

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BiblioGov. Paperback. Book Condition: New. This item is printed on demand. Paperback. 40 pages. Dimensions: 9.7in. x 7.4in. x 0.1in.We introduce a model problem to address heat entrapment effects or the local accumulation of thermal energy within liquid acquisition devices. We show that the parametric space consists of six parameters, namely the Rayleigh and Prandtl numbers, the aspect ratio, and heat flux ratios for the bottom, side, and top boundaries of the enclosure. For the range of Ra considered 1 to 10(sup 9), beyond Ra on the order of 10(sup 5), convective instability is the dominant mode of convection in comparison to natural convection. The flow field transitions to asymmetric modes at Ra on the order of 10(sup 7). Direct numerical simulation of a large geometric length scale prototype for Ra on the order of 10(sup 9) shows that the flow field evolves from small wavelength instability which gives rise to nonlinear growth of thermals, propagation of the instability occurs via growth of secondary and tertiary modes, and a travelling wave mode occurs prior to asymmetry. The effect of a large aspect ratio is to increase the number of modes in the vertical direction. Due to the slow diffusion of heat in the prototype, asymptotic states are not readily attained, we show that dynamical similarity can be used for a model which allows the attainment of asymptotic states and that transition to a chaotic state occurs for Ra on the order of 10(sup 9) via a broadband power spectrum. These dynamical events show that for the baseline condition in which heat is absorbed from background laboratory environment, higher heat flux is absorbed at the top and bottom boundaries of the enclosure than a nominal value of 34. 9 ergs per square centimeter-second. This item ships from La Vergne,TN. Paperback.

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