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Manipulation of Small-Scale Motions Induced by Self-Oscillating Reeds for Heat Transfer Enhancement SOURABH JHA, ARI GLEZER, Georgia Institute of Technology — Low Reynolds (*Re*) number forced convection heat transport within the fin channels of air-cooled condensers are enhanced by deliberate formation of unsteady, small-scale vortical motions using aero-elastically fluttering thin-film reeds that span the channel height. These vortical motions substantially increase the local heat transfer coefficient at the channel walls and mixing between the wall thermal boundary layers and the cooler core flow. The flow mechanisms associated with production, advection and dissipation of these small-scale motions are investigated in a modular, high aspect ratio channel using micro-PIV, video imaging of the reed motion, and hot-wire anemometry. The global heat transfer enhancement is investigated in a modular heat sink prototype using temperature and pressure measurements. It is shown that the reed-induced small scale motions increase the turbulent kinetic energy of the flow even when the base flow undergoes transition to turbulence, leading to an increase in the local and global Nusselt number (*Nu*) that is sustained at higher *Re* and a minor relative increase in losses. While these losses depend primarily on the reed's oscillation Strouhal number ($St=fL/U$) which is determined by the reed's mass ratio ($M*$) and structural rigidity ($U*$), because the global *Nu* depends only weakly on *St*, the losses associated with the presence of the reed can be strongly mitigated by reducing its *St* while maintaining the heat transfer enhancement.

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