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Superimposition of external oscillation to enhance heat transfer from objects in cross flow RAED BOURISLI, Kuwait University — Laminar flow around objects gives rise to the recurrent build-up and release of vortices on alternate sides of the objects over a wide range of Reynolds numbers. Inherent disturbance of the otherwise uniform flow and temperature fields plays an important role in many structural, hydrodynamic as well as thermal aspects of situations where it is present. For example, the local disturbance of the velocity field leads to subsequent instability in the temperature field, causing variations in local Nusselt number, heat flux and surface temperature, among other things. One can take advantage of this phenomenon in many applications such as the cooling of electronic equipment. It is suggested here that the intensity of the outlined vortex shedding phenomenon can be deepened if an external movement is superimposed on the velocity of the structure or any nearby object. Numerical test of several objects rotated in-plane: cylinders, squares, triangles and horizontal plates, are performed. The key physical observation is the relative magnitudes of the heat transfer due to natural vortex shedding compared to the added value obtained by superimposing an additional external source of oscillation. A realistic case of electronics chips cooling is presented to show the effect of matching the natural frequency of vortex shedding by that of the inhomogeneity (Video: 0-9 s optimum; 9-18 non-). In this case, vortex shedding from the plates plays a smaller role in disturbing the flow, hindering it at times. When the two frequencies coincide, however, in-phase shedding leads to more efficient heat transfer.

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