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A reciprocal theorem for convective heat and mass transfer in Stokes and potential flows HASSAN MASOUD, VAHID VANDADI, SAEED JAFARI KANG, University of Nevada, Reno — In the study of convective heat and mass transfer from a particle, key quantities of interest are usually the average rate of transfer and the mean distribution of the scalar (i.e., temperature or concentration) at the particle surface. Calculating these quantities using conventional equations requires detailed knowledge of the scalar field, which is available predominantly for problems involving uniform scalar and flux boundary conditions. Here, we derive a reciprocal relation between two diffusing scalars that are advected by oppositely driven Stokes or potential flows whose streamline configurations are identical. This relation leads to alternative expressions for the aforementioned average quantities based on the solution of the scalar field for uniform surface conditions.

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