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An Integral Method to Evaluate Wall Heat Flux in Oscillatory Wall-Bounded Flow ALIREZA EBADI, CHRISTOPHER WHITE, University of New Hampshire, IAN POND, YVES DUBIEF, University of Vermont — An integral method to evaluate wall heat flux in oscillatory wall-bounded flow is presented. The method is mathematically exact and has the advantage of having no explicit streamwise gradient terms. Importantly, the mathematical exactness of the method allows for a direct measurement of the wall heat flux without any a priori assumptions regarding the flow field or invoking flow transport analogies. It is useful in cases when measurements at multiple streamwise locations are not available or feasible, for flows with ill-defined outer boundary conditions, or when the measurement grid does not extend over the whole boundary layer thickness. The method is validated using DNS datasets of reciprocating turbulent channel flow with heat transfer for which independent estimates of wall heat flux were known, and the different results compare favorably. Complications owing to experimental limitations and measurement error in determining wall heat flux from the proposed method are presented, and mitigating strategies are described.

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