Abstract Submitted
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Integral Method for the Assessment of U-RANS Effectiveness in Non-Equilibrium Flows and Heat Transfer[1] IAN POND, University of Vermont, ALIREZA EBADI, University of New Hampshire, YVES DUBIEF, University of Vermont, CHRISTOPHER WHITE, University of New Hampshire — Reynolds Average Navier Stokes (RANS) modeling has established itself as a critical design tool in many engineering applications, thanks to its superior computational efficiency. The drawbacks of RANS models are well known, but not necessarily well understood: poor prediction of transition, non equilibrium flows, mixing and heat transfer, to name the ones relevant to our study. In the present study, we use a DNS of a reciprocating channel flow driven by an oscillating pressure gradient to test several low- and high-Reynolds RANS models. Temperature is introduced as a passive scalar to study heat transfer modeling. Low-Reynolds models manage to capture the overall physics of wall shear and heat flux well, yet with some phase discrepancies, whereas high Reynolds models fail. Under the microscope of the integral method for wall shear and wall heat flux, the qualitative agreement appears more serendipitous than driven by the ability of the models to capture the correct physics. The integral method is shown to be more insightful in the benchmarking of RANS models than the typical comparisons of statistical quantities.

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Yves Dubief
School of Engineering, University of Vermont, Burlington VT

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