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Adaptive wall functions for moving walls using the k-ω turbulence model JOHN AXERIO-CILIES, GIANLUCA IACCARINO, Stanford University — An adaptive wall function for the k-ω model is derived for moving walls starting from a wall-resolved RANS computation of the flow over a moving flat plate with zero pressure gradient. The wall function is implemented via lookup tables for the turbulence quantities and the friction velocity u_τ. The reference well-resolved, grid-converged RANS numerical solutions are obtained using the k-ω turbulence model with wall integration on very fine grids ($y+ < 1$). Selecting a reference frame such that $U_\infty \geq 0$ yields three distinct velocity profile regimes: $U_\infty \geq 0 < U_w$, $U_\infty \geq U_w \geq 0$, and $U_w > U_\infty \geq 0$. It is shown that adaptive wall functions are appropriate for all three velocity profile regimes as well as different Reynolds numbers when the near wall grid resolution is not sufficient ($y+ > 1$). For very fine grids ($y+ < 1$) this approach yields results consistent with the wall integration solution. Finally, the performance of the proposed adaptive wall functions is investigated for the complex flow around a rotating Formula 1 tire. The complexity of this flow arises from the impingement and jetting at the front of the tire, strong pressure gradients, and the large separated region behind the tire.

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