

Abstract Submitted
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Experimental and Analytical Limitations of Blockage Corrections¹ HANNAH ROSS, BRIAN POLAGYE, University of Washington — Flow confinement can significantly impact the performance of wind and water turbines. These effects become appreciable if the blockage ratio, defined as the turbine’s projected area divided by the cross-sectional area of the tunnel or channel, is larger than 5-10%. Due to experimental and computational limitations, studies are often conducted at blockage ratios that exceed this threshold. To estimate performance in unconfined conditions, analytical corrections can be applied to data collected in confined flow. Multiple analytical corrections based on linear momentum theory have been proposed in the archival literature. A previous study by the authors explored the effectiveness of these corrections when applied to experimental data from an axial-flow turbine and a cross-flow turbine. We found that, overall, estimates for unconfined thrust coefficients were more accurate than estimates for unconfined power coefficients. Here, we explore possible causes for this discrepancy in performance. Specifically, we examine the influence that Reynolds dependence and the assumptions that underpin linear momentum theory have on the effectiveness of the power coefficient corrections.

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