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Numerical Study of Trailing Edge Serrations on a Wells Turbine

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Abstract : The primary objective of this investigation is to explore the aerodynamic impact of adding trailing edge serrations to a Wells turbine. The baseline turbine consists of eight blades with NACA 0015 airfoils. The blade chord length was 0.125 m, and the span was 0.100 m. Two modified NACA 0015 serrated configurations were studied: 1) full-span and 2) partial span serrations covering the trailing edge from hub to tip. Numerical simulations were carried out by solving the three-dimensional, incompressible steady-state Reynolds Averaged Navier-Stokes (RANS) equations using the k-ω SST turbulence model in ANSYS™ (CFX). The aerodynamic performance of the modified Wells turbine to the baseline was made by comparing non-dimensional parameters of torque coefficient, pressure drop coefficient, and turbine efficiency. A comparison of the surface limiting streamlines was performed to analyze the flow topology of the turbine blades. The trailing edge serrations generated a substantial change in surface pressure and effectively reduced the separated flow region, thus improving efficiency in most cases. As a result, the average efficiency increased across the range of simulated flow coefficients.

Keywords : renewable energy, trailing edge serrations, Wells turbine, partial serration
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