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An Experimental Study to Investigate the Behaviour of Torque Fluctuation of Crossflow Turbines Operating in an Open Channel

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Abstract : Instream technology is the upcoming sustainable approach in the hydro sector for energy harnessing. With well-known cross-sections and regulated supply, open channels are the most prominent locations for the installation of hydrokinetic turbines. The fluctuation in generated torque varies with site condition (flow depth and flow velocity), as well as with the type of turbine. The present experimental study aims to investigate the torque/power fluctuations of crossflow hydrokinetic turbines operating at different flow velocities and water depths. The flow velocity is varied from 1.0 m/s to 2.0 m/s. The complete assembly includes an open channel having dimensions of 0.3 m (depth) x 0.71 m (width) x 4.5 m (length), along with a lifting mechanism for varying the channel slope, a digital transducer for monitoring the torque, power, and rpm, a digital handheld water velocity meter for measuring the flow velocity. Further, a time series of torque, power, and rpm is plotted for a duration of 30 minutes showing the continuous operation of the turbine. A comparison of Savonius, Darrieus, and their improved twisted and helical blades is also presented in the study. A correlation has also been developed for assessing the hydropower generation from the installed turbine. The developed correlations will be very useful in the decision-making process for development at a site.

Keywords : darrieus turbine, flow velocity, open channel, savoinus turbine, water depth, hydropower
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