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Study the effect of trailing edge flap deflection on horizontal axis wind turbine performance using computational investigation

- **ملخص البحث (الثالث) باللغة الإنجليزية**

Improving the aerodynamic performance of wind turbine blades is considered one of the most significant factors to maximize efficiency. This research aims to improve the aerodynamic performance for various ranges of operation wind speed using trailing-edge flap. An optimum blade shape was taken to construct the turbine geometry. The computational model was constructed by ANSYS FLUENT and the k-ω SST turbulence model was used. The computational domain was solved for optimum blade shape with and without trailing edge flap. Various flap deflections were studied for different wind speed and constant rotational speed. The results show that at certain wind speed the turbine performance characteristics were enhanced with increasing the deflection angle (δ) of flap until reach to the maximum improvement and then start to slightly drop. The optimum flap deflection angle changes according to the wind speed values and the optimum values are 5, 10 and 15 degrees at wind speed of 4, 7 and 10m/s respectively. The percentage improvement in lift force is about 9%, 17.06%, ٤٢.٢%، and in lift-to-drag ratio is about of 3%, 5%, 23.7% and in power coefficient of about 4.5% %, 17.5%, 17.7% for each wind speed respectively. This is mainly due to improving the stall characteristics over the blade, especially near the tip region.