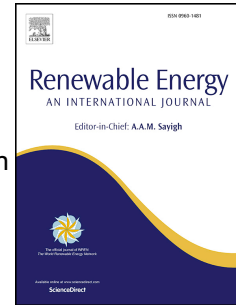


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Dynamic response analysis of Darrieus wind turbine geared transmission system with unsteady wind inflow

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9 ABSTRACT

10 Most of the wind turbines analysis studies have been conducted under steady and uniform
11 wind conditions. The unsteady flow past rotating rotor blades is, however, one of the most
12 challenging applications for a numerical simulation. This is attributed to the existing
13 aerodynamic complexities under such conditions. In this paper, a numerical approach to
14 investigate the global dynamic behaviour of a Darrieus turbine under unsteady and non-
15 uniform flow conditions is proposed. The dynamic response of Darrieus wind turbine geared
16 system operating in fluctuating inflow present a more significant challenge for this approach.
17 In this work, unsteady Computational Fluid Dynamic simulation is used to investigate the
18 aerodynamic performance. Using the validated numerical model, unsteady wind inflow
19 performance that affects the aerodynamic performance and the bevel gear dynamic response
20 is conducted.

21 The present results show that the dynamic behaviour of the Darrieus turbine geared system is
22 strongly affected by the fluctuating inlet velocity. As such, a change in the inlet velocity
23 results in the entire response changing in both the aerodynamic performance and the dynamic
24 vibration of the studied wind turbine.

25 The study results will hopefully be of importance to wind industries that require designs of
26 VAWTs operating in unsteady winds condition.

27

28 **Keywords:** Darrieus wind turbine, Computational Fluid Dynamics, Unsteady wind, Bevel
29 gear, Aerodynamic torque, Dynamic vibration

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