

ALGORITHMS FOR STABILIZING THE ROTOR SPEED OF A DARRIEUS WIND POWER PLANT CONTROLLED BY BLADE LENGTH VARIATION

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The world's power engineering features ever increasing attention to the development of renewable power sources. Difficulties in provision with traditional energy sources (gas, coal, and oil products) and the global trends of transition to green sources call for replacing the traditional sources with new ones. Among the alternative energy sources, wind power plants (WPPs) installed in suitable territories have received widespread use. Modern WPPs are of two types: vertical- and horizontal-axis ones. Vertical-axis WPPs, as distinct from horizontal-axis ones, have a number of specific advantages, such as, for example, insensitivity to wind direction changes, which significantly simplify the WPP design and increase the WPP reliability. Both WPP types are dynamically complex systems, which operate in different regimes depending on their dynamic and technological features. The task of matching these features is assigned to control systems, which control the rotor operation using additional devices, for example, generators of different types. For horizontal-axis WPPs, approaches to the solution of a number of system control problems have been developed on the basis of the principle of swept area variation. The development of a similar approach for vertical-axis WPPs seems to be an important and promising task. The goal of this paper is to develop efficient algorithms of WPP rotor speed stabilization using the principle of swept area variation, namely, telescopic blades. The problem is solved using methods of the classical automatic control theory and mathematical simulation. The novelty lies in extending the concept of control by swept area variation to Darrieus vertical-axis WPPs, synthesizing efficient algorithms for stabilizing the rotor speed of Darrieus vertical-axis WPPs controlled by blade length variation, and determining conditions for their stability. The algorithms may be used in substantiating design solutions for Darrieus rotor vertical-axis WPPs.

Keywords: *wind power plants, Darrieus rotor, rotary speed stabilization, stability, mathematical simulation.*

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