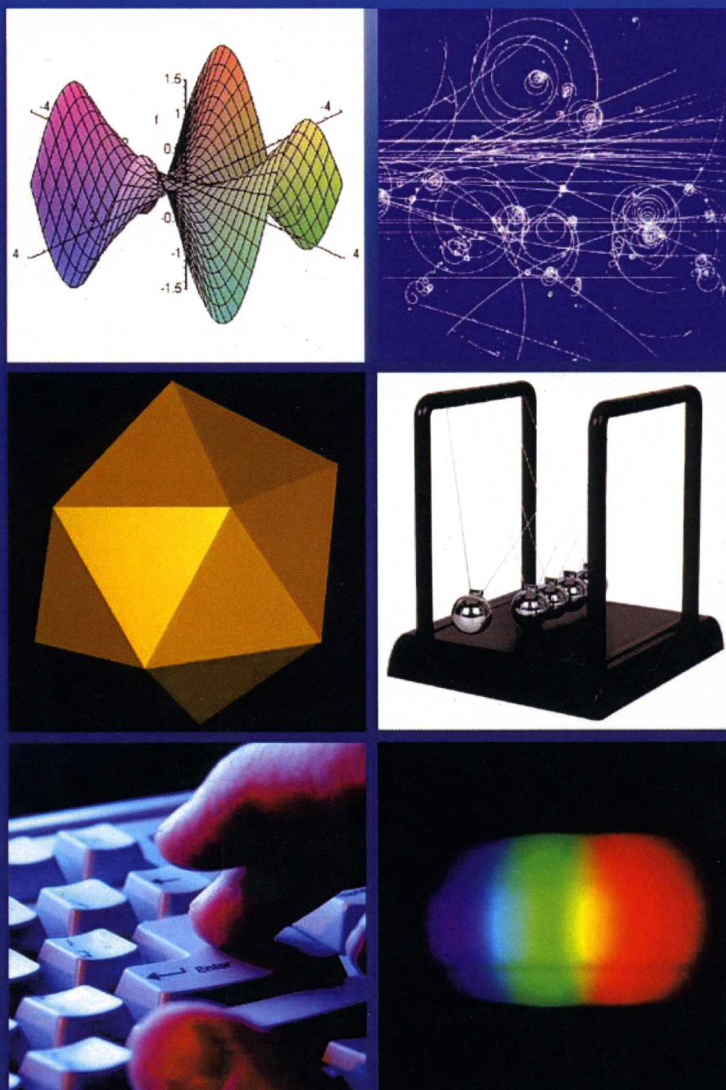


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The effect of design parameters on energy characteristics of Darrieus rotor

Abstract. In the last 10-15 years the use of wind energy is growing. There are more than 20,000 wind power turbines with a total capacity of more than a few megawatts in the world. Kazakhstan has significant wind power resources. Resources of the Jungar gate and Shelek complex in Almaty region are the best known in this respect. Their capabilities for use in electricity generation of air flow are unique. This article describes the main types of wind turbines and the benefits of Darrieus rotor over other wind turbines. The article provides the basic calculations to determine the effect of the wind turbine Darrieus design characteristics on its energy efficiency. This article shows the dependence of the maximum utilization coefficient of wind energy vertical axis windwheels from the number of blades with constant filling factor σ , from the number of blades with their constant width, from blades elongation λ . Design characteristics for 1 kW rotor were identified based on these results. Also, wind turbine scheme, that can provide thermal protection by warm air natural ventilation in the rotating elements of wind turbine which arises due to centrifugal forces, is shown.

Key words: Darrieus rotor, rotation shaft, windturbine, the fill factor, thermal protection, ideal rotor.

Introduction

In the last 10-15 years the use of wind energy is quick stepping to new peaks. There are more than 20,000 wind electric set so far in the world, the total capacity of which is more than a few megawatts.

The possibility of electric power generation is defined by the construction of wind turbines. All the wind turbines consist of blades that rotate axis connected to a generator, which generates a current.

The size and capacity of wind turbines are fluctuating widely. There are three main types of wind turbines: with horizontal axis, with vertical axis and channel.

Currently the horizontal axis or so called propeller type turbines are mainly used in the world. They compose more than 90% of the total number of wind farms, and some thousand companies are engaged in their serial production.

The vertical axis wind turbines were not developed for almost 40 years because of the improper conclusion on low rate of wind energy operation of vertical axis wind turbines. And only at the end of the last century, firstly Canadian and then American and British specialists have proved

experimentally that these conclusions do not apply to the Darrieus rotor of blade lift [1].

This paper specifies that the propeller type wind turbines can significantly reduce the generated electricity with frequent changes in wind direction. When the wind direction is changed rapidly the wind wheel must accurately track these changes, but it is almost impossible to effectively orient the wind wheel when changing the wind direction due to delay in orientation mechanisms action.

Recently the majority of foreign companies began to give priority to the new type of wind turbine with vertical axis of Darrieus rotor (see Fig. 1). The turbine operates due to the occurrence of the lift on cover blades equidistant from a common axis of rotation.

The advantage of vertical axis wind turbines is the possibility of placing the generator on the turbine base. This eliminates the strong, most likely multi level angle drive of torque simplifying the requirements for the installation of equipment (exclude limitations on size and weight) and for the maintenance conditions (lack of shocks and vibrations). It facilitates the transmission of electricity generated.