V.M. KORENDIY (UKRAINE, LVIV)

COMBINED MECHANICAL SYSTEMS OF POWER REGULATION OF HORIZONTAL-AXIS WIND TURBINES

Lviv Polytechnic National University

Most modern investigations and developments are devoted to improvement of commercial wind turbines (WTs) of middle and large power (more than 100 kW), which are mainly used for electric energy producing. At that «small» wind energetics develops essentially slower and the problems of improvement of mechanical systems of power regulation of small WTs (less than 10 kW) are disregarded in most cases. We cannot make the most out of world experience of creation and exploitation of WTs of middle and large power taking into consideration low potential of air flows on the territory of Ukraine. Herewith multiblade horizontal-axis WTs of low power are very perspective on huge part of Ukrainian territory. Creation of sufficiently accurate, effective and reliable mechanical regulation systems for multiblade low-speed WTs is extremely important problem.

Combined mechanical system of blades turning and folding (fig. 1, a) may be received by combining of the mechanism of blades folding with the mechanism of blades turning round their own longitudinal axis. The presence of hinges B and D, which are placed on rotor hub, allows blades turning round two mutually perpendicular axes. The sliders H_1 and H_2 may be immovably joined or connected by spring elements. Combining of blades turning (folding) system with the mechanism of wind-wheel getting out of wind direction (fig. 1, b, c) is another perspective method of power regulation, which can be effectively used by way of anti-storm protection system. In that case, tail-plane joins with nacelle with the help of cylindrical hinge and interacts with nacelle through spring element. Wind-wheel can be equipped with side blade P (fig. 1, b), which is used for wind-wheel sideways turning relative to wind direction when wind speed rising over its nominal value. Similar effect can be achieved as a result of wind-wheel axis side-shift relative to tower axis (fig. 1, c) or, in other words, when existing of eccentricity between wind-wheel and tower axes. Side blade size, wind-wheel axis eccentricity value and regulation spring rigidity should be determined depending on wind-wheel and tail-plane sizes and nominal (design) values of wind speed and rotation frequency.

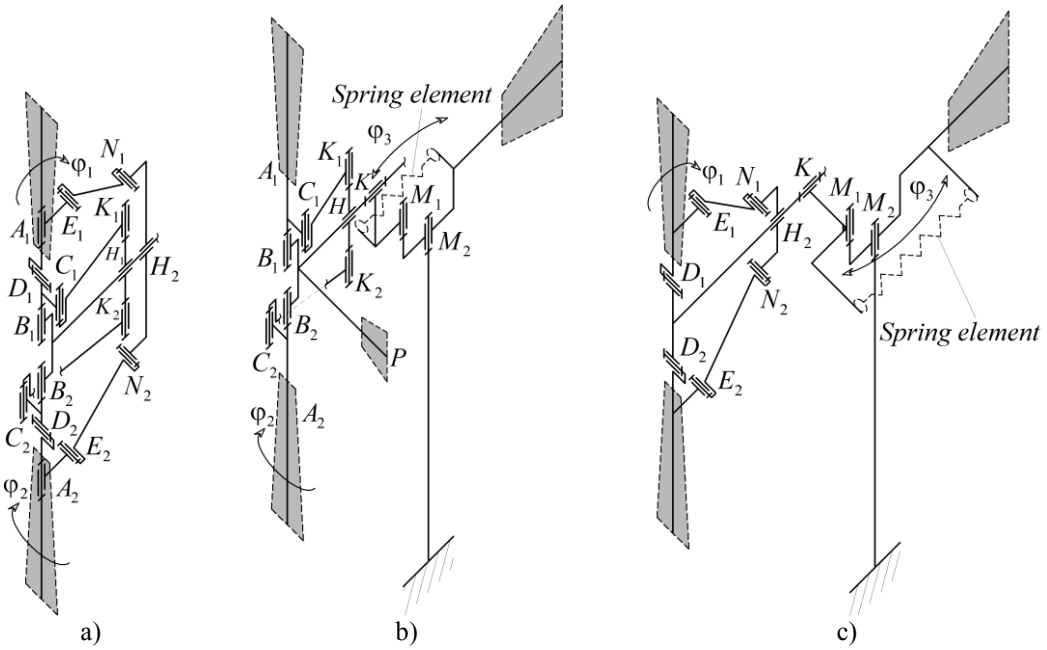

Fig. 1. Kinematic diagrams of combined mechanical systems of WT power regulation