

OPTIMIZATION OF THE SHAPE OF VERTICAL AXIS WIND TURBINE ROTOR USING POD BASED REDUCED ORDER APPROACH

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The unrestricted access to the energy sources is one of the most important elements conditioning fast development of civilisation. However, in view of the climate changes caused by unlimited use of fossil fuels further development is greatly dependent on the effective utilisation of renewable energy sources. One of the most important energy source which utilisation is relatively easy which is not burden significantly the environment is the wind energy. Nowadays, energy production from wind is dominated by huge horizontal axis units (horizontal axis wind turbines – HAWT) which possess relatively high efficiency, however this construction suffers from high starting wind speed and relatively low cut off wind speed. Moreover, this type of wind turbines generates high noise and have significant impact on the environment. Finally, connecting this type of wind turbines into the energy system is very problematic due to random character of energy production. Some alternative to HAWTs may be vertical axis units (Vertical Axis Wind Turbine – VAWT). The vertical axis wind turbines are completely omnidirectional, almost insensitive on the wind turbulence and they can produce energy at lower rotational speeds, that is why it can be considered as a power generation units for municipal computations. However, these constructions are still at very low level of developemnt and needs investigation, especially in terms of complicated flow around operating rotor. The paper presents methodology of optimization of the shape of rotor of typical VAWT by combination of the reduced order model of operating windt turbine and Evolutionary Algorithm. This methodology allowed us to increase significantly the rotor performance comparing to the traditional solutions which are considered as an experimentally optimised.

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