

Chapter 15

Vertical Axis Wind Turbines. Optimal Positioning of the Blades Defined by Asymmetrical Airfoils



Bostan Viorel, Bostan Ion, Rabei Ivan, Gutu Marin, and Dulgheru Valeriu

Abstract Many Vertical Axis Wind Turbines (VAWTs) have blades defined by asymmetrical (cambered) airfoils. There can be two possibilities regarding the orientation of their camber in relation to the rotor's axis: radially inward or outward. The objective of this study was to experimentally determine the relevance of this aspect and the version that comes with higher efficiency. The asymmetrical FX 63-137 airfoil was considered. On the same turbine, the blades were first attached with the camber oriented inward and then oriented outward, for both cases the pitch angle being set to zero. The outward mode proved to be much more efficient. The optimization of the pitch angle was pursued for the camber inward version so besides 0° a few more values were tested: 8° , -8° , -16° . Even though the performance was significantly improved due to this step, the efficiency was still much lower than that for the camber outward mode for which the pitch angle was not optimized at all.

Keywords Vertical axis wind turbine · Asymmetrical airfoil · Camber in · Camber out

15.1 Introduction

The extended use of fossil fuels over the last century facilitated higher living standards but their application is considered as one of the main climate change causes [1]. Renewable energy sources are deemed as replacement solution and extensively implemented with the sun and the wind energy being the top choices [2]. Large horizontal axis wind turbines are indubitable leaders for converting wind energy. Small scale vertical axis wind turbines are recently gaining popularity as research topics and market products. Though less efficient, these offer a series of advantages that make them attractive. The main one is their insensitivity to changes of the wind

B. Viorel · B. Ion · R. Ivan · G. Marin · D. Valeriu (✉)
Technical University of Moldova, Stefan cel Mare Bd. 168, 2004 Chisinau, Republic of Moldova
e-mail: valeriu.dulgheru@bpm.utm.md

B. Viorel
e-mail: viorel.bostan@adm.utm.md