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

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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.