

Graduate Studies Program:
Academic Year 2015 - 2016

**"Renewable Energy Systems: Design,
Development and Optimization"**

Supervisor's Name: Dr Dimitrios Sagris

Subject:

Parametric design and evaluation of vertical axis wind turbines for residence application

Introduction & Motivation:

Wind turbines present an increasing usage in residences worldwide. The proposed thesis investigates the design and performance optimization of a vertical axis wind turbine. The goal of the thesis is to investigate the use of vertical axis wind turbines as residences' application, by means of computational fluid analysis and experimental tests on a scaled structure, automatically controlled by a real-time system. The investigation will include the most common geometric models of vertical axis wind turbines, automated control system selection and evaluation for the arising power maximization, as well as structural components for the design, focused on an optimum balance of performance and cost. An analysis of fluid, structural and automation parameters will be performed, in order to gain useful data for this technology.

Implementation & Means:

- Theoretical analysis of vertical axis wind turbines and their performance
- Design of 3D parametric model of vertical axis wind turbine using dedicated software
- Parametric analysis of fluid, structural and control system for energy absorption and performance optimization of vertical axis wind turbine

References:

- [1] Howell, R., Qin, N., Edwards, J., Durrani, N., Wind tunnel and numerical study of a small vertical axis wind turbine, *Renewable Energy*, 35 (2), pp. 412-422, 2010.
- [2] Islam, M., Ting, D.S.-K., Fartaj, A., Aerodynamic models for Darrieus-type straight-bladed vertical axis wind turbines, *Renewable and Sustainable Energy Reviews*, 12 (4), pp. 1087-1109, 2008.

Requirements: Good knowledge of Computational Mechanics, Experience on construction of prototypes