**Title:** Accuracy and Cost Analysis of Wind Turbine Blade Modeling in Multibody Dynamic Formulation

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**Background:** Modern wind turbine blades are flexible, slender and very long structures, which have large displacements and rotations during the operational life of the turbine. Some wind turbine analysis tools (HAWC2 and Bladed [1]) use multibody formulation to capture the large displacements and rotations of the wind turbine structures (especially the blades). It is necessary to model blade structures with multiple bodies to see the geometric nonlinear effects. However, as the number of bodies increases, the computation time becomes longer because of the increased number of constraint equations. On the other hand, to calculate the turbine response accurately, we need to include nonlinear effects. At this point, the problem becomes a trade-off analysis between accuracy and cost.

The aim of the project is to develop a simple method to determine the number of bodies for a cost effective blade modeling with acceptable accuracy. We can list the objectives as:

(i) Develop a simple method (or use the existing method) considering the blade stiffness distribution and wind turbine type to determine the accurate and cost effective number of bodies in blade model
(ii) Test accuracy and cost of the method for various load cases
(iii) Evaluate the results in terms of loads, controller activity, energy production etc.

**Content/approach:** The analysis of the wind turbine will be performed in HAWC2 [2]. The student will perform multiple load case analysis [3] for the blade models with different number of bodies and evaluate the existing or his/her approach for a cost effective and accurate turbine analysis in multibody formulation.

Student should have:

(i) Interest in wind turbine design, loads & aeroelasticity of wind turbines (any course related to these topics would be helpful.)
(ii) Knowledge on HAWC2 or wind turbine modelling
(iii) Programming skill in any computer language

**Deliverables/outcomes:**

(i) Aero-servo-elastic analysis results of the selected wind turbine for different blade models
(ii) Evaluation of the results in terms of accuracy and cost

Report and presentation of the work

**Relevant literature:**