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# GUST WIND LOAD REDUCTION IN WIND TURBINE BLADES

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**Summary:** The work in development seeks a new insight about the implementation of composite materials in the wind energy field. Large wind turbine blades have many advantages in terms of power, efficiency and noise, despite representing an hazard concerning the loads applied on the structure and particularly on their sturdiness. Traditionally there are active control systems that allow the blades to adapt themselves to the change on wind speed, and so maintain power efficiency within acceptable levels. These systems consist mainly of pitch and rotor velocity control systems.
Since the end of the last century, some researchers have been discussing about passive control techniques. Once wind turbine blades are built by anisotropic materials, it is possible to control pitch angle without an active control system, moreover it is not necessary to add any weight in order to meet stiffness requirements. In fact, with this approach, unlike the active control, there are no additional devices or complementary structures. Furthermore, it does not require a reduction on maintenance interval, as a correct design will maintain or even reduce the chance of failure. Additionally, some studies suggest that it might exist gains in fatigue life and avoid both static and dynamic aerolastic instabilities such as divergence or flutter. Passive control is very useful either to reduce fatigue loads or optimize energy output. The principle behind it is known as aerolastic tailoring and refers to customization at structural design level, in such way that enables improvements in both aerodynamic and mechanical properties of the structure. Passive control can be achieved by bending torsion coupling. In practice, it means that a sudden gust wind will cause a change in bending moment and torsion, and consequently a variation in effective angle of attack. The main purpose is to achieve an effective reduction in aerodynamic loading which may lead to an increase of blade's lifetime.
Right inside the scope of this work, it is interesting to understand the parameters that allow the blade to twist in order to reduce the effective angle of attack and justify this aerolastic behaviour as part of any early design stage. The research in progress will try to give some answers about how to achieve the purposes described above. Some authors suggest that a correct stacking in the composite material can bring beneficial effects to the structure, although they assume high bend-twist coupling might compromise the material stiffness. Thus, it will be explored the influence of both fibers orientation and layer thickness in the coupling between bending and torsion, aiming to achieve an effective reduction in blade's twist angle when subjected to significant change in wind speed.