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## Fatigue testing of the HAWT composite structure


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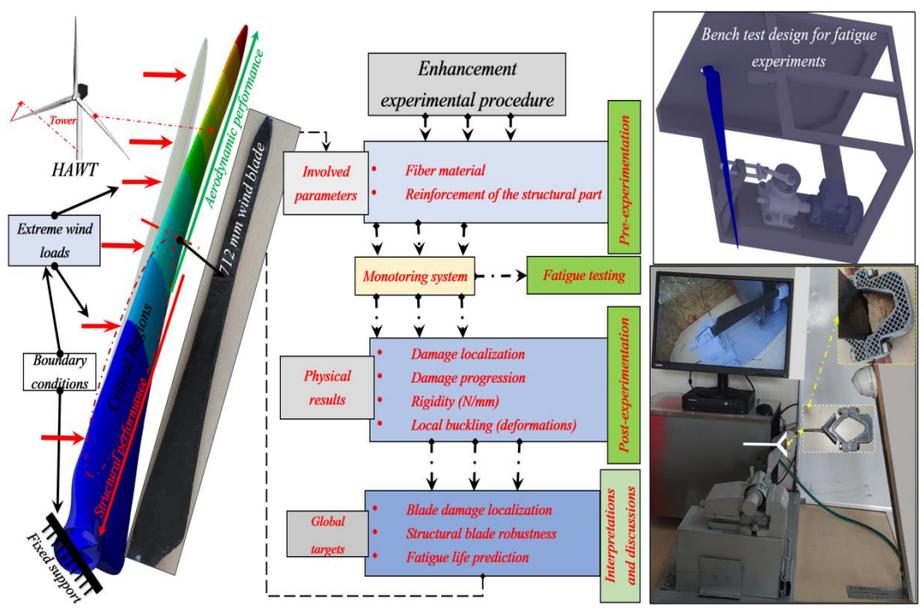
## Abstract

In this study, the performances of the composite materials of a blade prototype in terms of rigidity and mechanical resistance are studied. By applying a set of load levels in different directions of loading, we will characterize and quantify the degradation of the rigidity of the structure as a function of the loading rate and the number of cycles of the fatigue testing. In this concordance, a test bench was designed, manufactured and assembled in our laboratory in order to test the 712 mm long blade in bending and this to characterize the structure in terms of fatigue resistance, damage tolerance and other proposals to improve the overall composite structure of the blade.

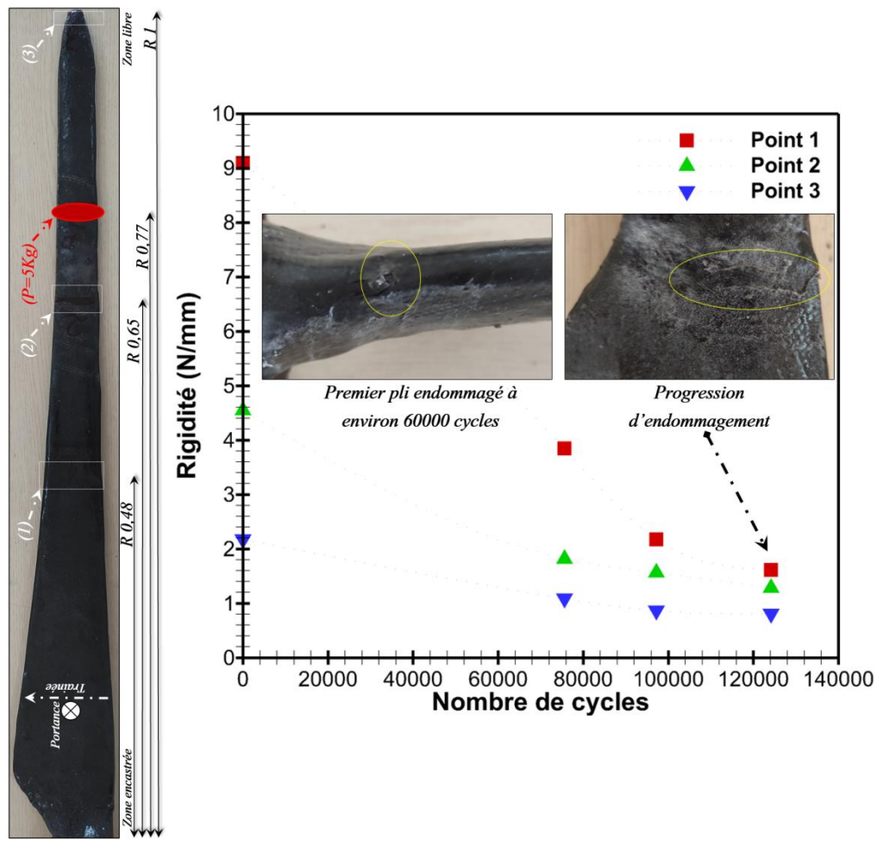

## Context

the blades are the most important parts of the wind turbines [1], and they must have low mass moment of inertia to ensure a quick response as wind changes direction . In addition, the blades of the *HAWT* have to resist to severe environment operating conditions and fatigue effect for at least a lifespan of 20 years . However, during the operation of the wind turbine, the blades have to withstand the extreme wind loads that may occur . As a result, it is common that many wind blades fail atastrophically during typhoon seasons [2].

## Methodology




## Results




## Conclusion and perspectives

During this preliminary study of the experimentation of the composite structure of the blade using a designed and fabricated bench. In this regards, the blade would be subjected to fatigue charges and a system of detection of damages would be employed. Moreover, the rigidity control is performed during the fatigue tests. The obtained results validate our predicated numerical results using ANSYS in terms of important local buckling, rigidity degradation and tolerance of damage that maybe exploited for blade durability.

## References


1. Chen, X., Haselbach, P.U., Branner, K., Madsen, S.H.: Effects of different material failures and surface contact on structural response of trailing edge sections in composite wind turbine blades. Compos.Struct. **226**, 111306 (2019))
2. Liu, X., Cheng, L., Li, G.,Godbole, A., Chen,Y.: Effects of aerodynamic damping on the tower load of offshore horizontal axis wind turbines. Appl. Energy **204**(Supplement C), 1101–1114 (2017) 11