P.Chaviaropoulos, *"Flap/Lead-lag Aeroelastic Stability of W/T Blades"*, Journal Wind Energy, Vol 4, pp. 183-200, (2001).

Abstract

A numerical tool for investigating aeroelastic stability of a single wind turbine blade subjected to combined flap-lead lag motion is presented in this paper. Its development is motivated by recent concern on destructive "edge-wise" vibrations of modern stall controlled blades. The stability tool employs finite element formulation to discretize in space the structural and aerodynamic governing equations. Unsteady aerodynamics is considered by means of the extended ONERA lift and drag models. The mathematical form of these models allows for a combined treatment of dynamics and aerodynamics through the introduction of a so-called "aeroelastic beam element". This is an extended two-node beam element having both deformation and aerodynamic degrees of freedom. Several linear and non-linear versions of the stability tool are available, differing on the way that instantaneous lift and/or drag is treated. In the linear case, stability is investigated through eigenvalue analysis. Time domain integration is employed for non-linear stability analysis. Results are presented and discussed for a 17m stall controlled blade.

Keywords

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