On Vibration Control of Transiently Excited Structurally Damped 3- Bladed Rotor

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ABSTRACT

Designers of bladed rotors often confront the problem of accumulation of damage due to frequent transient excitations of varying magnitude. Considering rotors such as wind turbines, varying wind velocity is one of many sources of transients. The excitations may result in symmetric or antisymmetric responses in a three-bladed rotor. Although air damping may reduce vibrations under favourable conditions improved structural damping in the blades may provide some vibration reduction in all modes, including lead-lag vibrations. Optimal location of suitable damping material in the blades depends upon the nature of the excitation [1]. Tower vibration may be the most frequent scenario resulting in symmetrical rotor blade vibration.

In subarctic climate a frequent excitation is the sudden release of ice from the tower or from one of the blades. This paper deals with the analysis of ice throw excitations of a medium size, horizontal axis turbine of about 20 m diameter.The model considered is fitted with a rigid hub with some motion allowed in the axial direction; thus blade boundary conditions aer obtained.An integration of a linear partial differential equation representing deterministic flap vibration is carried out numerically. Vibration amplitude variations with time are envisaged, and structural modifications are suggested. It is found that some improvement may be anticipated by applying damping material in selected parts of the blade.

[1] Bratt, Johan F., On transient excitation of a damped two-bladed rotor. Proc IS-CORMA-1 South Lake Tahoe ,CA,USA,August 2001.