

NDT 2018 - 57th Annual British Conference on Non-Destructive Testing, 10-12 September 2018, East Midlands Conference Centre and Orchard Hotel, Nottingham, UK.

Autonomous ice protection combining ultrasonic guided waves and electrothermal systems

Abstract

Ice accretion on wind turbine blades can have implications both on the energy produced as well as the lifetime of the asset. The build-up of ice on the surface of wind turbine blades contributes to the wear and tear of the components leading to increased operation and maintenance (O&M) costs and decreased turbine lifetime. This paper reports progress in development of a hybrid ice-protection system that integrates ultrasonic anti-icing and electrothermal de-icing capabilities to optimise performance across a wide range of environmental conditions. Firstly, we have modelled propagation of ultrasonic waves in different composites that are used to construct wind turbine blades. The three main observations are: (i) ultrasonic waves propagate along the fibre direction, (ii) generated sound field is strongly influenced by the transducer position and (iii) different frequencies can be used to cover the complete composite area (20-70 kHz). Secondly, we have coupled an ultrasonic transducer to a number of composite panels and then have scanned them using a Laser Scanning Vibrometre. The experiments support the modelling and it is clear that we can achieve uniform distribution of waves on the surface of the composites. The results are encouraging for proceeding with the development of the hybrid system to achieve maximum protection at minimum energy cost, improve energy generation efficiency (up to 50%) and significantly further reduce the cost of energy from offshore wind.

Cite as: Kostan, M., Dhutti, A., Niu, X., Duan, W., Kourmpetis, M., Kanfoud, J. et al. (2018) 'Autonomous ice protection combining ultrasonic guided waves and electrothermal systems'. NDT 2018 - 57th Annual Conference of the British Institute of Non-Destructive Testing. Nottingham, UK, 10-12 September 2018, pp. 100 - 111.