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Study of Ageing in the Marine Environment of Bonded Composite Structures by Ultrasonic Guided Waves. Comparison of the Case of a Conventional Carbon-epoxy Composite and a Recyclable Resin-Based Composite

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Abstract : This study is dedicated to the evaluation of the ageing of turbine blades in sea conditions, based on ultrasonic Non Destructive Testing (NDT) methods. This study is being developed within the framework of the European Interreg TIGER project. The Tidal Stream Industry Energiser Project, known as TIGER, is the biggest ever Interreg project driving collaboration and cost reductionthrough tidal turbine installations in the UK and France. The TIGER project will drive the growth of tidal stream energy to become a greater part of the energy mix, with significant benefits for coastal communities. In the bay of Paimpol-Bréhat (Brittany), different samples of composite material and bonded composite/composite structures have been immersed at the same time near a turbine. The studied samples are either conventional carbon-epoxy composite samples or composite samples based on a recyclable resin (called recyclamine). One of the objectives of the study is to compare the ageing of the two types of structure. A sample of each structure is picked up every 3 to 6 months and analyzed using ultrasonic guided waves and bulk waves and compared to reference samples. In order to classify the damage level as a function of time spent under the sea, the measure have been compared to a rheological model based on the Finite Elements Method (FEM). Ageing of the composite material, as well as that of the adhesive, is identified. The aim is to improve the quality of the turbine blade structure in terms of longevity and reduced maintenance needs.

Keywords : non-destructive testing, ultrasound, composites, guides waves
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