# Vibration analysis of a partially submerged structure using the DIC technique

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The continuous expansion of offshore wind turbine sites has been garnering increasing attention, particularly in countries where available land is limited. Nevertheless, efficiently allocating resources for the maintenance and repair of offshore wind turbines presents a formidable challenge. This challenge is compounded by the complex and often unpredictable weather conditions, as well as various business-related issues specific to the offshore environment. To tackle these challenges, one effective solution is to implement vibration analysis through the use of digital image correlation (DIC) methods. This approach has a well-established theoretic background dating back to approximately 2008 and has demonstrated its effectiveness in the realm of structural health monitoring for large structures like bridges and towers. Relevant information on the upper structure of the wind turbines has been obtained using numerical models in our previous work. Changes in the structural feature frequencies of wind turbines are the primary focus in vibration analysis. However, changes in feature frequencies can occur for various reasons, and relying solely on frequency shifts can make it challenging to pinpoint the precise areas of damage within wind turbine structures, especially without the benefit of long-term observations. In this study, the DIC method is employed on scaled cylindrical models to gain insights into the frequency variations stemming from the erosion of non-cohesive soils beneath offshore wind turbine foundations. Changes in modal curvature within the upper structure of the wind turbine will also be analyzed. This additional investigation will enable a clear differentiation between defects in the upper structure and frequency shifts resulting from erosion or problems with the underwater foundation.