

Hybrid FRP-Concrete-Steel Double-Skin Solutions for Sustainable Offshore Wind Support Structures

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ABSTRACT

The past decade has seen rapid development of offshore wind energy around the world. To improve the efficiency of power generation, wind turbine development has been trending towards increasingly large power, tall height and deep water. These developments call for innovations in the form of wind turbine towers to address the challenges faced by existing tower forms in structural adequacy, construction efficiency and maintenance (Shamir et al. 2023). This research presents a new form of hybrid wind turbine towers (Figure 1) which possesses many important advantages over the existing tower forms and are particularly suitable for the next-generation offshore wind turbines. The new hybrid towers, termed herein hybrid FRP-concrete-steel prestressed double-skin wind turbine towers or PDSWTs, are prefabricated in segments and then assembled on site. The PDSWT segments are a variation of hybrid FRP-concrete-steel double-skin tubular members (Teng et al. 2007; Yu et al. 2017). In this research, the rationale behind the development of PDSWTs is first explained, followed by a discussion of the design procedure supported by existing codes to facilitate the practical applications of the new tower form. A series of member-level experimental studies have been conducted and the test results have verified the fundamental assumptions in the design of PDSWT segments. Lastly, the future research needs of PDSWTs are discussed.

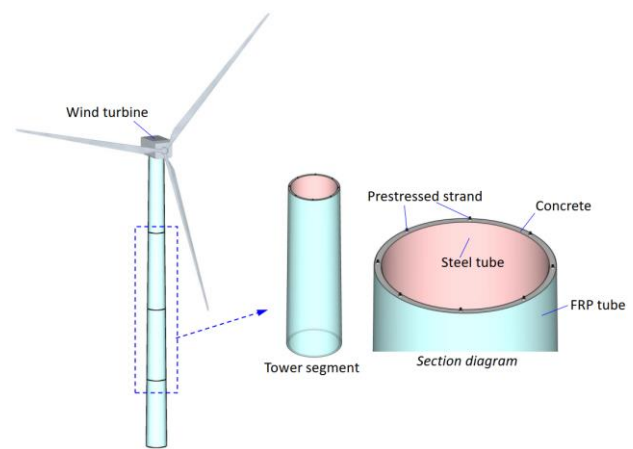


Figure 1: Hybrid FRP-concrete-steel tower.

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