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Automated arc welding and quality assessment of large scale support structures for offshore wind turbines

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Offshore wind energy plays an important role for the desired transition towards a carbon dioxide free industry within the next decades. However, the grounding of the offshore wind plants governs the overall installation process besides bureaucratic bottlenecks.

The application of lightweight principles in steel construction, e.g. the usage dissolved load-bearing structures, so called Jackets foundations, offer great potential in reducing the resource consumption, especially with respect to the needed amount of steel.

In this context this document focuses on a fully digitalization of the welding manufacturing and as well as testing chain to enable a fully automated manufacturing as well as quality assessment of tubular nodes as key element of Jackets foundation structures. Furthermore, the relationship between the seam shape geometry and resulting fatigue strength is evaluated by numerical methods incorporating bionic principles. It is shown that tubular nodes can be welded fully automatically taking geometry tolerances into account. Moreover, the seam shape could be manufactured as requested by the numerical models which offers great potential for an extended lifetime. Subsequently, the improvements in resource efficiency and reduction of carbon dioxide emissions are evaluated by a life-cycle-assessment.