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Coupled 3D models of permanent magnet generators with very large diameters and with a special focus on losses

Generator is the key component of the WECS. For offshore application, the design of generator should take into account all of the offshore features: hash environment, large unit preferred, high reliability required and compact design desired. Furthermore, generator design is a highly multidisciplinary task that involves knowledge from electromagnetic, thermal design and so on. PM machine is very promising in offshore wind application. So far, a lot of research has been conducted on the radial flux machine and machine up to 4MW is now available in the commercial market.

Ironless AFPM machine is very promising in term of torque density and high efficiency, and it can be a competitive solution to meet the demand for large power (4-10MW) high performance generator in offshore wind application. However, there are insufficient knowledge on high power ironless AFPM, such as how to choose the slot/poles combination, how this combination influences the machine parameters, losses and torque, and how to accurately predict the machine performance with the latest modeling approach without making the expensive prototype.

The focus of this research work is to research and develop the 3D modelling approach in design of 10MW ironless axial flux permanent machine. Accurate modeling approach is to be studied, especially in losses/torque calculation. System level modeling approach and coupling modeling of EM-Thermal field is to be studied.

In this research, an analytical method for sizing of the ironless AFPM machine is to be developed. 3D FEA that is commonly regarded as the most accurate approach is to be adopted. In order to reduce the solving time in FEA, high performance computing (HPC) platform will be established for this research.