CHALMERS

ELKRAFT 2017

The Effect of the Magnet Placement for an IPM WEC Generator

Background and Aim

According to studies conducted in 2005, the wave energy potential in the EU has been estimated to be 120- 190 TWh/year offshore and an additional near-shore potential of approximately 40 TWh/year, which makes it a viable renewable energy source, as wind and solar energies. Even though the electric generation part of the wave energy converter is small in dimension, an efficient generation unit has a significant impact on the total efficiency. In this paper, effects of the variations of the magnet placement on the torque production of an IPM machine which is used as a generator for wave power applications are investigated.

Wave availability and WEC system

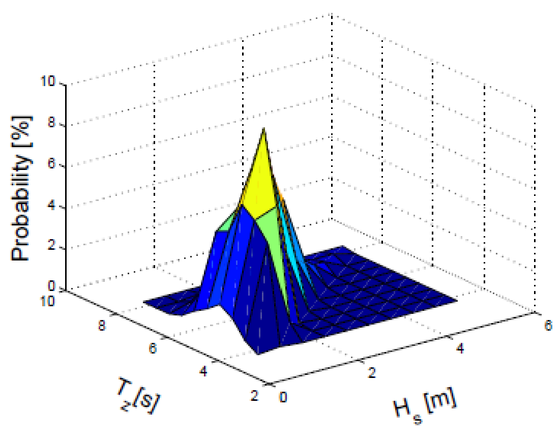

Fig. 1 The Scatter Diagram.

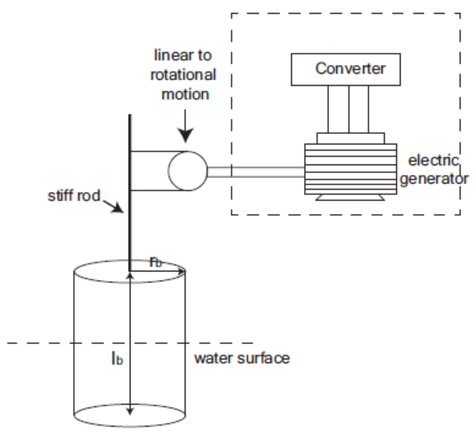

Fig. 2 The WEC Configuration.

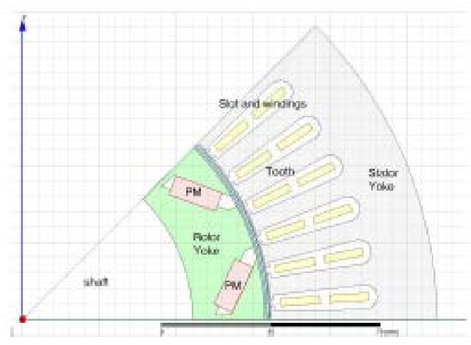

Fig. 3 The initial generator design.

Case Study and Analysis

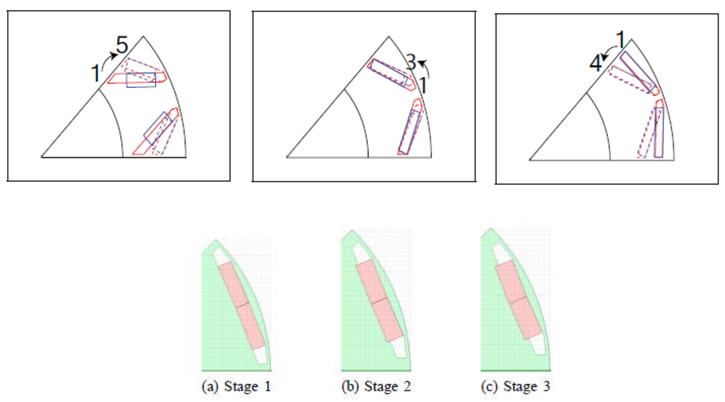

Fig. 4 Sweep geometries for the v-shaped and inset PM generators.

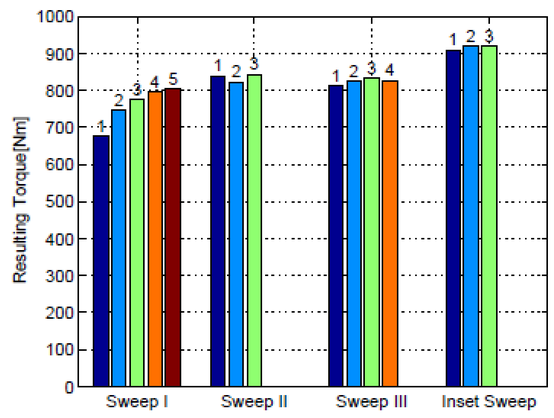

Fig. 5 Resulting torque for different sweeps.

Simulation Results

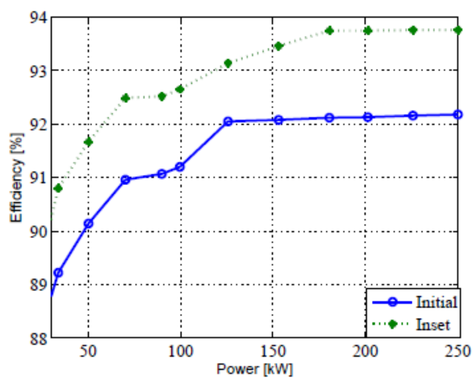

Fig. 7 Efficiency comparison of the initial and inset IPM systems.

THE HIGHEST TORQUE VALUES FOR EACH SWEEP AND THE CORRESPONDING STAGE NUMBER.

Parameter	Initial IPM system	Inset IPM system
Converter losses [kW]	4.5	3.9
Machine losses [kW]	17.5	13
Total losses [kW]	22	16.9
Efficiency [%]	92.2	93.8

Conclusions

- **Analyzing the permanent magnet location shows that the inset design is the most favorable from an energy point of view, the torque production is increased by 15%.**
- **The rated operation can be reached by 14% less current if the inset design is used as the WEC generator, therefore the machine and converter losses decrease. The efficiency increases by 2%.**

Financed by Chalmers Energy Area of Advance.

Presented at ICEM, Laussanne Switzerland, September 2016.

Chalmers University of Technology
Department of Energy and Environment

Pinar Tokat
Division of Electric Power Engineering
pinar.tokat@chalmers.se