

Master project, 2018-2019

— Design and study of a doubly excited PM synchronous generator —

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Context:

In the case of medium power hydro-alternator, permanent magnet synchronous machines are very interesting and widely used at constant speed directly connected to the grid. Indeed, such machines are very reliable and compact. However, it cannot be possible to adjust the magnetic flux density in such machines and then to modify, and thus improve, the power factor of the machine at load. The actual solution consists in using capacitive banks of different values but this remains a sensitive solution.

Objective

The goal of this master’s work is to study the possibility to add a second excitation circuit by mean of a second DC current excitation winding in order to improve the performance of the PM hydro-alternator in terms of power factor modulation. The location of the added circuit should be well chosen in order to avoid any negative impact on the initial PM excitation and high DC current magnitudes.

Different works have already been carried out on doubly excited synchronous machines but mainly with the aim of the PM addition to a DC current excitation circuit to in order to increase the efficiency [1-5].

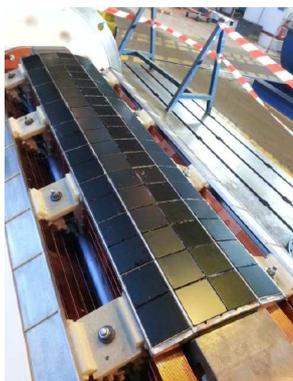


Fig. 1: Serie dual excitation generator [2]

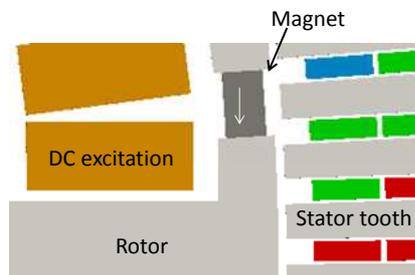


Fig. 2 : PM compensation wound rotor synchronous generator [5]

Work steps

- State of the art and bibliographic research on dual excitation generators
- Analytical study and design of a dual excitation synchronous machine
- Study and simulation of a dual excitation generator whose specifications will be defined by B&B.

References

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[3] S. Hlioui, L. Vido, Y. Amara, M. Gabsi, M. Lecrivain, and A. Miraoui, ‘PM and hybrid excitation synchronous machines: Performances comparison’, *18th International Conference on Electrical Machines, ICEM 2008*.

[4] K. Yamazaki, K. Nishioka, K. Shima, T. Fukami, and K. Shirai, ‘Estimation of assist effects by additional permanent magnets in salient-pole synchronous generators’, *IEEE Transactions on Industrial Electronics*, vol. 59, no. 6, pp. 2515–2523, 2012

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