MODELING AND ANALYSIS OF DUAL THREE-PHASE SELF-EXCITED INDUCTION GENERATOR FOR WIND ENERGY CONVERSION SYSTEMS

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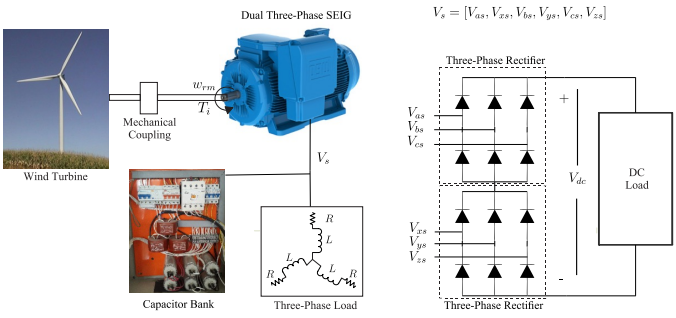
Abstract

Multiphase self-excited induction generators have recently become more deeply interesting due to its advantages, compared to its equivalent three-phase generators, such as post-fault operations and lower torque ripple. However, as an induction generator, it has some limitations regarding poor voltage and frequency regulation under varying load and speed regimes. A steady state analysis is fundamental to comprehend the machine's behavior. For a more precise modeling, a non-linear variation of the magnetizing inductance is considered. This paper presents a detailed mathematical model and analysis of the dual three-phase self-excited induction generator for wind energy conversion systems connected to different loads. Simulation results are provided to show the behavior of the machine and its build up voltage through different load conditions.

Block diagram of a DTP SEIG for WECS



Simulation Results

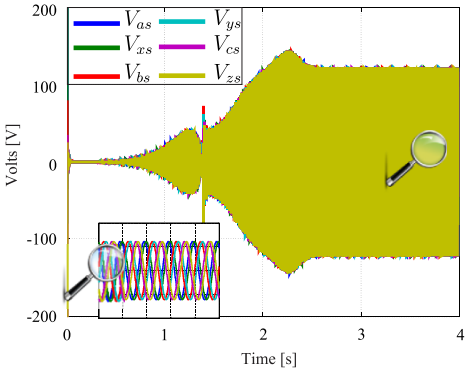


Fig 1. Output voltaje of the DTP SEIG with no load.

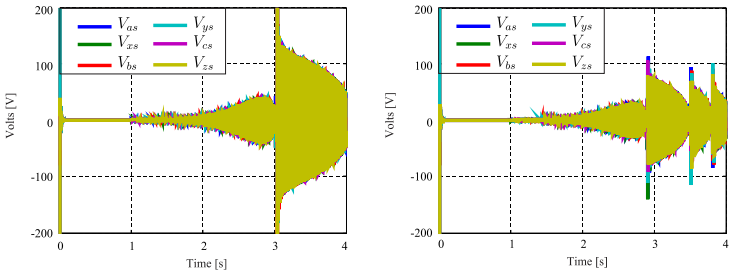


Fig 2. Output voltaje of the DTP SEIG with no load when the self-excitation has failed
$C_{\alpha s} = C_{\beta s} = 40uF$ (left) $w_r = 772.5$ rpm (right)

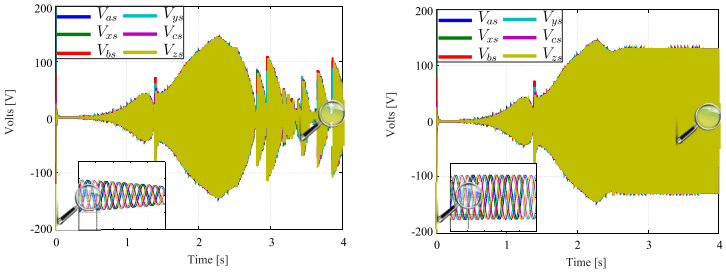


Fig 3. Output voltaje of the DTP SEIG with load
R_L = 10 Ω (left) R_L = 50 Ω (right)

Conclusion

In this paper, the model of the DTP SEIG is presented. The results have shown that the capacitance of the excitation capacitor must be precisely calculated in order to obtain a successful build up process of the DTP SEIG. The output voltage magnitude depends of the variation of the mechanical rotor speed, where decreasing the rotor speed will lead to decrease the output voltage. The output build up voltage process also follows the variation of the magnetizing inductance. At last, the load current is another factor which could affect the self-excitation process, so it is important to know the load limits the DTP SEIG can operate to guarantee a successful self-excitation process.

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