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Increased Efficiency of a Permanent Magnet Synchronous Generator through Optimization of NdFeB Magnet Arrays[1] HELENA KHAZDOZIAN, RAVI HADIMANI, DAVID JILES, Department of Electrical and Computer Engineering, Iowa State University — The United States is currently dependent on fossil fuels for the majority of its energy needs, which has many negative consequences such as climate change. Wind turbines present a viable alternative, with the highest energy return on investment among even fossil fuel generation. Traditional commercial wind turbines use an induction generator for energy conversion. However, induction generators require a gearbox to increase the rotational speed of the drive shaft. These gearboxes increase the overall cost of the wind turbine and account for about 35 percent of reported wind turbine failures. Direct drive permanent magnet synchronous generators (PMSGs) offer an alternative to induction generators which eliminate the need for a gearbox. Yet, PMSGs can be more expensive than induction generators at large power output due to their size and weight. To increase the efficiency of PMSGs, the geometry and configuration of NdFeB permanent magnets were investigated using finite element techniques. The optimized design of the PMSG increases flux density and minimizes cogging torque with NdFeB permanent magnets of a reduced volume. These factors serve to increase the efficiency and reduce the overall cost of the PMSG.

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