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Moduling Axial-flux Compensated Pulsed Alternator

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Compensated pulsed alternator (CPA) is a kind of device supplying power for pulsed equipment such as pulsed laser, accelerator and electromagnetic railgun. The most widely researched scheme of CPA is the air-core self-excitation one which is capable of supplying high current and power. But it needs a bulky capacitor to provide seeding current and a prime motor which complicates the power system and reduces its reliability. Besides, multi-phase discharge sometimes is hard for traditional air-core CPA because of the coupling of phases. The moduling axial-flux compensated pulsed alternator (MACPA) is designed to simplify the system and decouple the affect among phases. The MACPA consists of decoupled modules including discharging portions and motor portion. And it is excited by permanent magnet (PM) which saves the capacitor and complicated self-excitation process. Firstly, the structure of MACPA is proposed including discharging module and motor module. Then, fundamental of MACPA and principle of decoupling are investigated for proving the feasibility of the moduling scheme. Afterward, the dynamic characteristics of MACPA is analyzed insuring the safety of the machine, because the rated speed is high. Finally, a 3-D Finite Element Method (FEM) model is built, and functions of motor and multi-phase discharge are tested. The simulation results show that the MACPA can decouple the affect among phases efficiently and integrate the function of discharge and motor into one machine, which is a new way of thinking in designing CPA.

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