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Mon-Af-Po1.22-07 [105]: A Novel Flux Reversal Claw Pole Machine with Soft Magnetic Composite Cores

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Flux reversal permanent magnet machine (FRPMM) is a special kind of permanent magnet machine with the permanent magnet (PM) installed on the stator side and there is no winding or PMs on the rotor side. Claw pole machine (CPM) is a special kind of transverse flux machine (TFM), with the adopted claw pole teeth, the torque ability and power factor of CPM can be even higher than those of TFM. Combing above two machines, this paper proposes a novel flux reversal claw pole machine (FRCPM) with soft magnetic composite (SMC) cores, the proposed FRCPM has both the advantages of flux reversal permanent magnet machine (FRPMM) and claw pole machine (CPM). Specifically, with the permanent magnets (PMs) are surface mounted on the surface of stator claw pole teeth with a determined pattern, the FRCPM can operate based on flux reversal principle. As the adopted winding is global ring winding and 3D magnetic flux stator core structure is similar to the CPM' s, the FRCPM is operated based on magnetic flux characteristic of the CPM as well. Therefore, the FRCPM can be operated under relatively high rotate speed since there is no winding or PMs on rotor, and the weak PMs, ring winding and SMC stator cores are encapsulated together as a whole part. Moreover the adopted 3D magnetic flux path can bring FRCPM with relatively high torque ability, and the adopted SMC cores can bring FRCPM with low core loss at the high speed operation. The operation principle of FRCPM is explained, the power equation is deduced for obtaining the initial design, and the main dimensions are optimized to ensure the developed FRCPM can have good performance. The main electromagnetic parameters and performance of FRCPM are obtained based on using the 3D finite element method (FEM).

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