Improving the Performance of a Synchronous Reluctance Machine through the use of Composite Magnetic Materials

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Description
In the present paper, we investigate the improvement of the synchronous reluctance machine performance using a new soft magnetic composite material. This work highlights potential technology applications of the new soft composite magnetic materials in the design of electrical machines. A numerical simulation carried out on the SynRM has shown that the electromagnetic performances such as torque and magnetic losses are better for SMC materials than for laminate materials for a supply frequency beyond f= 500 Hz. Subsequently, an optimization of the machine has been performed using the so-called response surface method (SRM) by acting on the most influential geometric parameters of the machine. As a last step, an experimental study is carried out on SynRM in order to validate the finite element results. are obtained by mixing particles of iron powder «20 μm to 200 μm» with high purity and coated with a fine electrical insulator as shown in Figure 1 [2]. This choice results in the very good magnetic features.
Soft magnetic composites (SMCs) have been widely used in electromagnetic devices with alternating magnetic fields such as transformers, electric motors, electromagnets, and alternators. This is due to the fact that ferromagnetic metal powders exhibit excellent mechanical ductility, magnetic isotropy, high magnetic saturation, and low hysteresis loss