A Novel Axial Flux Synchronous Reluctance Induction Hybrid Motor

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The goal of this project was to create a better alternative to permanent magnet synchronous motors, by enhancing specific characteristics of the synchronous reluctance motor. Specifically, inductive cores, offset 90 degrees from one another, were utilized to increase the rotor's initial angular velocity, at which point it would be close enough to the angular velocity of the 4 pole rotating magnetic field for the reluctance effect of the iron cores to take effect. To increase the available torque band for the motor, an axial flux type layout was chosen, to increase the magnetic flux interaction. These factors, utilized in combination, created the best possible motor with the available resources. Permanent magnet synchronous motors(PMSMs) are inherently flawed, in that they have major supply chain issues, negative environmental effects, as well as terrible performance in specific circumstances. At high speeds, PMSMs generate massive amounts of reverse EMF on the stator windings, preventing additional torque production. PMSMs also have to be cooled vigorously when utilized in demanding circumstances, because the permanent magnets will physically demagnetize if they overheat. This adds another point of complexity, cost, friction(coolant running through the axle into the rotor in many designs), and ultimately, possible failure. As for the environment, the mining of rare earth metals for magnets needed for these motors is responsible for human rights abuses, and the destruction of habitats and water sources by toxic pollution, such as ammonium sulfate and thorium. And in terms of supply chain, China produces approximately 90 percent of the worlds' rare earth magnet supply, and given current foreign relationships, this makes rare earth magnets unsustainable.

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