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Mon-Af-Po1.21-13 [100]: Design of New Novel Shape Rotor by Inductance Changes for Power Improvement and Extended Operating Range

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This study shows the novel rotor shape of the spoke-type PMSM for a washing machine to improve power and widen operating range by changes of inductance in the rotor and air gap. Applying a new shape to the rotor results in an inductance change in some areas of the rotor in which low magnetic flux density existing, which in turn changes the magnetoresistance in the air gap. As the inductance changes, the inductance of the rotor d-axis decreases and the q-axis inductance increases to improve the reluctance torque. We investigated to maximize the reluctance torque and air-gap magnetic flux density with a novel rotor shape. In other words, low magnetic flux density area which help rarely torque increase was subtracted. In addition, it also can extend operating range as the saliency is maximized. The Finite Elements Method analysis results show that the back-electromotive force decreases as the saliency increases. As a result, the maximum speed range of the designed motor can be widen and it is applicable to the motor requiring high speed range. For instance, washing machine needs high speed motor in dehydrating mode to remove moisture from clothes.
It is contrast to the common technologies that increasing coil turn for power improvement results in increasing back-electromotive force. Accordingly, it was confirmed that average torque improves as some area of rotor where magnetic flux density is low, was removed. A prototype has been manufactured and is now being under experiment. The results of power improvement and operating range widened will be compared and verified.

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