



Contribution ID: 421

Type: **Poster Presentation of 1h45m**

Design principle of WFSM for Electric Vehicle based magnetic-thermal equivalent circuit

Monday 28 August 2017 13:15 (1h 45m)

INTRODUCTION: Following to the recently emerging environmental regulations and energy depletion, HEV and EV draw attention as future cars. And there are many studies carried out for traction motor design. This study is about a design algorithm which can make wound field synchronous motor design easier and faster. Because main flux path is sensitive to magnetic saturation and heat problem is caused in a rotor by copper loss, basic design considering that problems is necessary especially in case of high torque density application. Non-linear magnetic equivalent circuit is constructed to calculate non-linear design parameters of motor exactly and a thermal equivalent circuit is also made to select accurately current density. This paper proposes the basic design algorithm based on the non-linear magnetic and thermal equivalent circuits and accuracy of equivalent circuits is verified by a comparison with FE analysis. A basic design of 140kW-class wound field synchronous motor is done with the proposed basic design algorithm. And a test results of final model design will be added in the full paper.

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Session Classification: Mon-Af-Po1.04

Track Classification: E1 - Motors