PM Generator No-Load Additional Loss Calculation Using FE Models with an Equivalent Current Layer

Xiaoli Cui, Bogdan Funieru, Andreas Binder
Institute of Electrical Energy Conversion, Darmstadt University of Technology, Germany
Landgraf-Georg-Strasse 4, D-64283, Darmstadt, Germany
E-mail: bfunieru@ew.tu-darmstadt.de , tel: +49-(0)-6151/165694, fax: +49-(0)-6151/166033

Abstract

Two numerical methods for calculating the no-load additional loss in a PM hydro-generator with a copper damper cylinder are presented. Open stator slots cause considerable air-gap flux density ripple, which may induce remarkable additional losses even at no load mainly in the copper damper cylinder. With both methods the additional losses are calculated by considering the field slot harmonics, which appear due to this field ripple. This field ripple is modeled by an equivalent current layer. The first method adopts a harmonic linear formulation considering the rotor at stand still and requires linear material constants. For the second method a moving conductor formulation that needs homogeneous material in the direction of rotation is used. Due to the rather low value of the flux density in the non-linear rotor yoke iron and due to low losses in the magnet segments, both methods give nearly the same results for losses in damper cylinder.

(*Topic area:* C3 Machine Design)