FINITE ELEMENT 2-D MODELING OF ELECTROMAGNETIC DEVICES
TAKING ACCOUNT OF THE ROTATION

AJAY KUMAR, SANJAY MARWAHA, & ANUPAMA MARWAHA

Abstract

In this paper, we present a general method to include time periodic movement in the finite-element (FE) simulation of rotating electromagnetic (EM) devices. The rotation is modeled by using COMSOL Multiphysics with coupling variables using a rotation coordinate transform. The method is generalized one and for 2D FE model of a rotating machine, it only requires elementary manipulations of the rotational transform matrix. The method has been applied to permanent magnet (PM) rotor generator. It is shown how circular motion of rotor with permanent magnets and non linear magnetic material generates an emf in a stator of the same magnetic material. The nonlinearity of the magnetic material is modeled using an interpolation function. The flux density, electric field and magnetic vector potential for the generator have also been computed during rotation.

Keywords: Electromagnetic devices, Finite-element method, permanent magnet rotor generator, rotation transform.