COMPUTATIONAL AND EXPERIMENTAL MODELLING OF NONCONVECTIONAL WINDING SLOT COOLING

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The paper is concerned with computational simulation of stator winding heating of the synchronous machine. Software ANSYS 8.0 was used for computational simulation. Computational model considers heat pipe in the middle of winding slot. The results of computer simulation show the effect of a heat pipe on winding cooling. Other simulations show the effect of direct winding cooling with water. The results of both methods of cooling were compared. Experimental device was created for verification of computational simulations.

Key words: *cooling, heat pipe, water cooling, electric machines, CFD analyse, temperature measuring*

1. Introduction

The paper is concerned with computational simulation of stator winding heating of synchronous machine. The synchronous machine operates as high-torque machine with continuous torque 675 Nm at 50 rpm. Software ANSYS 8.0 was used for computational modelling. Computational simulations describe direct stator winding cooling using heat pipe and water cooling.

2. Cooling with heat pipe

A heat pipe is a simple device that can quickly transfer heat from one point to another. Heat pipes are used in a wide range of products like air-conditioners, refrigerators, heat exchangers, transistors, capacitors, etc. Heat pipes are also used in laptops to reduce the working temperature.

2.1. Computational model

The computational model geometry (Fig. 1) arises from real synchronous machine. It describes the heat of part synchronous machine mainly of stator winding. The machine has 36 pair of winding slot and permanent magnets on the rotor. Rotor with magnets is not modelled, because the heat loss is only in the stator winding and rotor effect is negligible on the heating of stator. Symmetry of machine was assumed so only one pair of winding slot is modelled. Computational model correspond with experimental device (Fig. 8).

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