Saturation of Nanocrystalline Cores in DC Systems

Master Thesis Assignment / Student Assignment

Theme:	Electromagnetic Compatibility
Application:	Filtering
Contact Person:	**Rodica Botnarevscaia**
External collabolator:	*Not applicable*

I. Introduction:

Summary:

At the time of secondment, a situation of heating a nanocrystalline core in CMC was encountered at a manufacturing facility. The task was to understand the causes of this process. One of the causes of core heating may be saturation of the nanocrystal core. In order to check the saturation process it was decided to check the conditions under which the core reaches this limit.

Problem definition:

The proposition states that the core reaches saturation when the inductance of the coil wound around it decreases to 30% of its initial value.

II. Description

Method:

Under laboratory conditions, a circuit (DC) should be assembled to test a nanocrystalline core. Gradually increasing the current in the first winding, measure the change in inductance in the second winding (identical in parameters). Then, gradually decrease the current in the first winding and record the change in inductance in the second winding. The inductance values will differ when the current is increased and decreased due to residual magnetization. Based on the obtained data, construct a hysteresis loop to confirm or refute the 30% decrease in inductance during saturation. For testing purposed multiple different cores will be available. Additionally, examine how the data changes when the cores are connected in series. What changes will there be if there is an air gap on the core.

Research objectives:

1) Verify the statement about 30% reduction of inductance at the moment of core saturation.
2) Familiarize oneself with relevant literature and articles on the saturation of toroidal nanocrystalline cores.
3) Conduct laboratory experiments.
4) Perform simulations using the Comsol program (if feasible).
5) Present mathematical calculations derived from the conducted research.

Contact Information

{**Botnarevscaia Rodica, r.botnarevscaia@utwente.nl**}

University of Twente. (UT)

Faculty of Electrical Engineering Mathematics and Computer Science (EEMCS)

Radio Systems (RS) Group

III. Requirement courses, skills and supervision:

General knowledge on fundamentals of electrical engineering, electromagnetic properties of materials (magnetically soft, magnetically hard materials). MATLAB experience.

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