ELEC 0041: Project - due on May 18, 2018

You are asked to study and compare single- and three-phase voltage transformers of both core and shell types. Sample data files

- `transfo.geo`,

- `transfo.pro`,

- `transfo_common.pro` and

- `Lib_Magnetodynamics2D_av_Cir.pro`

are provided for a simple core-type transformer with unit dimensions, physical properties and excitations, to be adapted for each studied case.

Single-phase transformers

For primary and secondary voltages of 240 and 24 V respectively (frequency 50 Hz), you are asked to propose some designs for nominal powers of 50, 500 and 5000 VA, and to perform the numerical tests (open and short circuit tests) allowing the determination of the equivalent circuits of the transformers (as studied e.g. in the Electromagnetic Energy Conversion course). The exterior characteristic of the transformer should be calculated on the final designs.

The windings are to be designed for allowing reasonable Joule losses. The magnetic core is to be designed for allowing the magnetic flux density to be lower than the saturation induction of the chosen magnetic material (typically around 1.8–2 T). Additional parameterized studies are to be done to point out the effect of the winding electric resistivity, the core magnetic permeability and the possible presence of an air gap.

Other studies showing the effect of a non-laminated core, the effect of a tank/shield surrounding the transformer and the effect of higher operating frequencies are to be done as well.

Bonus points will be awarded if the linear phasor-model models are extended to nonlinear, time-domain models, with a realistic saturation curve for the core.

Three-phase transformer

A classical three-phase voltage transformer is to be defined and simulated. This can be done as a simple extension of the single-phase core type transformer: addition of one core leg, definition of additional primary and secondary coils with the related circuit connections). You are asked to produce results showing the the main behaviors of such a transformer.

Report

By groups of 2, write a report where you present and comment your results.

Send your report by email to `cgeuzaine@uliege.be` in PDF format together with your model files, bundled in a single `.zip` file. The file should be named: `hw3_Lastname1_Lastname2.zip`.