

## ELEC 0041: Homework 3 - due on May 17, 2019

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You are asked to design two three-phase 50 Hz transformers with primary and secondary voltages of 30 kV and 240 V, respectively: the first with a nominal power of 10 kVA, the second with a nominal power of 100 kVA.

You should perform numerical tests to determine their equivalent circuits (using open and short circuit tests: see e.g. [http://www.montefiore.ulg.ac.be/~geuzaine/ELEC0431/2\\_Transformer.pdf](http://www.montefiore.ulg.ac.be/~geuzaine/ELEC0431/2_Transformer.pdf)), and compute their exterior characteristic.

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, the effect of higher operating frequencies and the loss of one phase are to be done as well.

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

### **Report**

Write a report where you present and comment your results.

By groups of 2, write a max. 20 page report where you present and comment your results. Send your report by email to [cgeuzaine@ulg.ac.be](mailto:cgeuzaine@ulg.ac.be) in PDF format together with your model files, bundled in a single .zip file. The file should be named: `hw3_lastname1_lastname2.zip`.