

End winding characterization

3D Technical Example Summary

Introduction

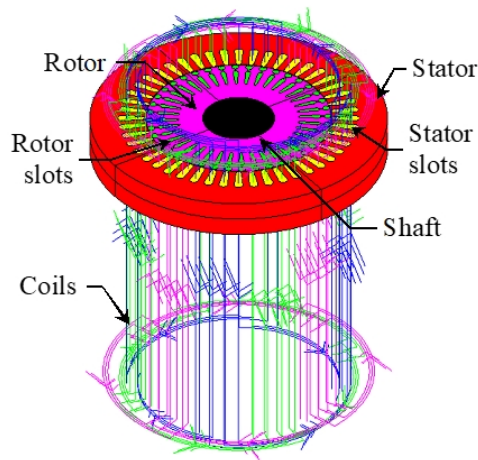
This chapter describes the device and introduces the theoretical aspects of the end winding reactance in asynchronous machines and inductance computation principle.

| Post-processed quantities | Applications | Flux main functions |
|---------------------------|----------------|--|
| Inductance | Magneto Static | Sensors Computations on physical entity |

Studied device

The device to be analyzed is a three-phase induction (asynchronous) motor. The motor under study consists of two parts:

- an outside stationary stator having 12 coils, each passes through four stator slot
- an inside squirrel-cage rotor attached to the output shaft



Note:

The end winding and the end ring inductances, because of their geometry, only a 3D model can give good results.

This technical paper details methods for the computation of end winding stator inductance with Flux software in 3D application.

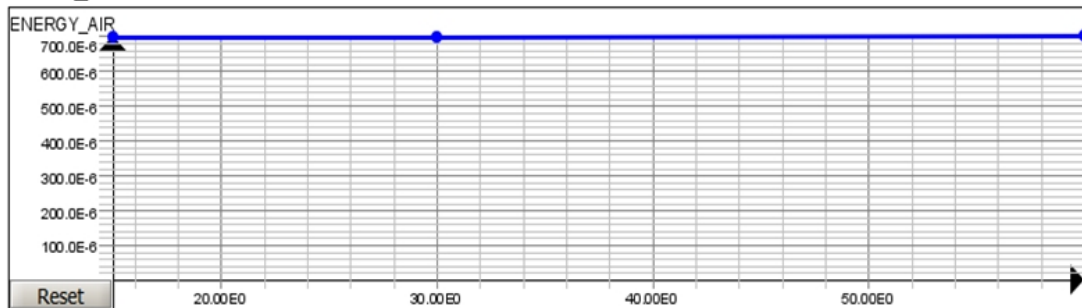
The results will be compared with the main analytic formulas.

Example 1: Reference computation

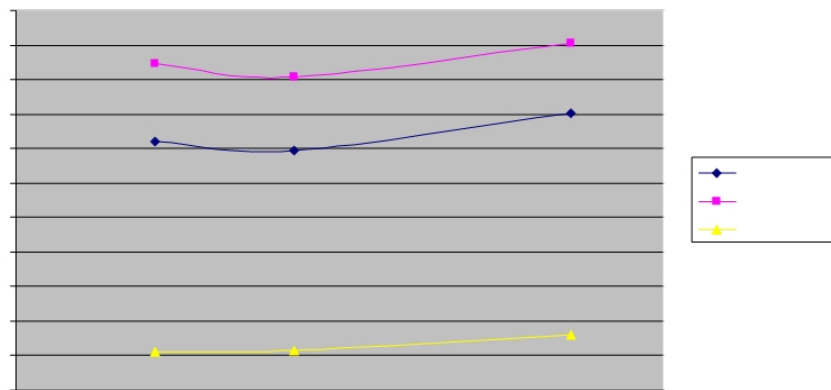
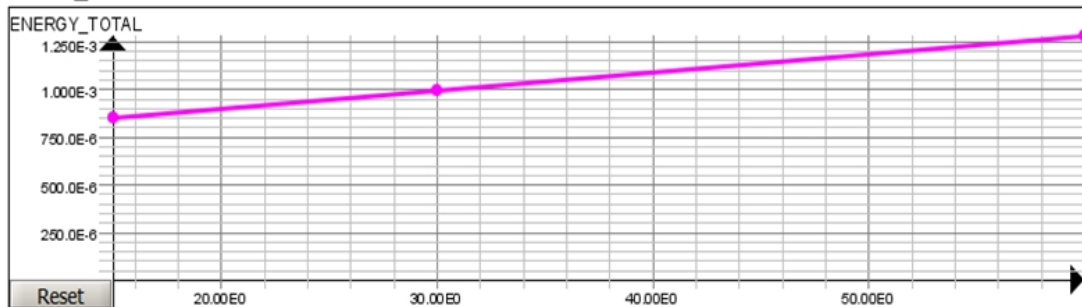
This computation can be considered as a reference computation since it is based on the experimental test record of the end windings inductance recognized by the IEC norms. The norms do not take the rotor into account; we need to make computations only in the regions of the stator.

To simplify the model, we use small values of current with linear approximation for the B(H) characteristic of magnetic materials.

ENERGY_AIR

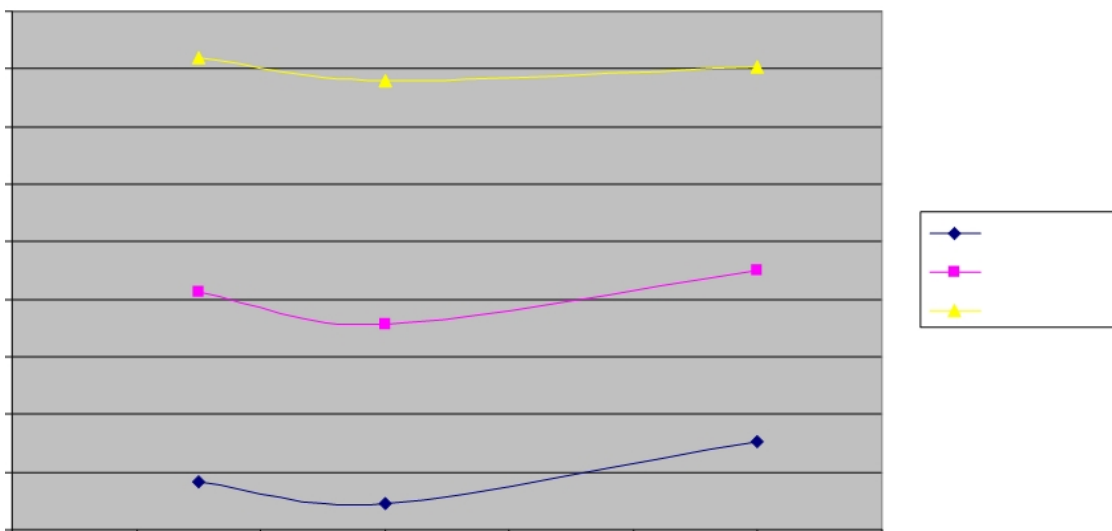
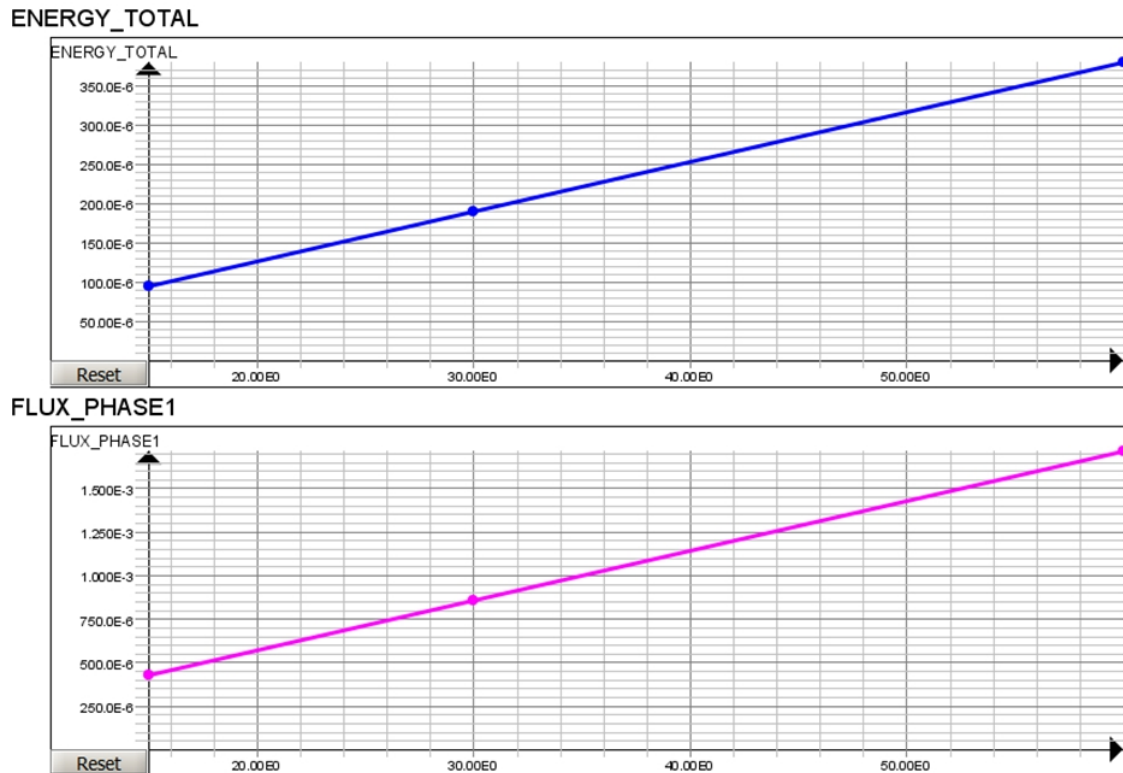


ENERGY_TOTAL



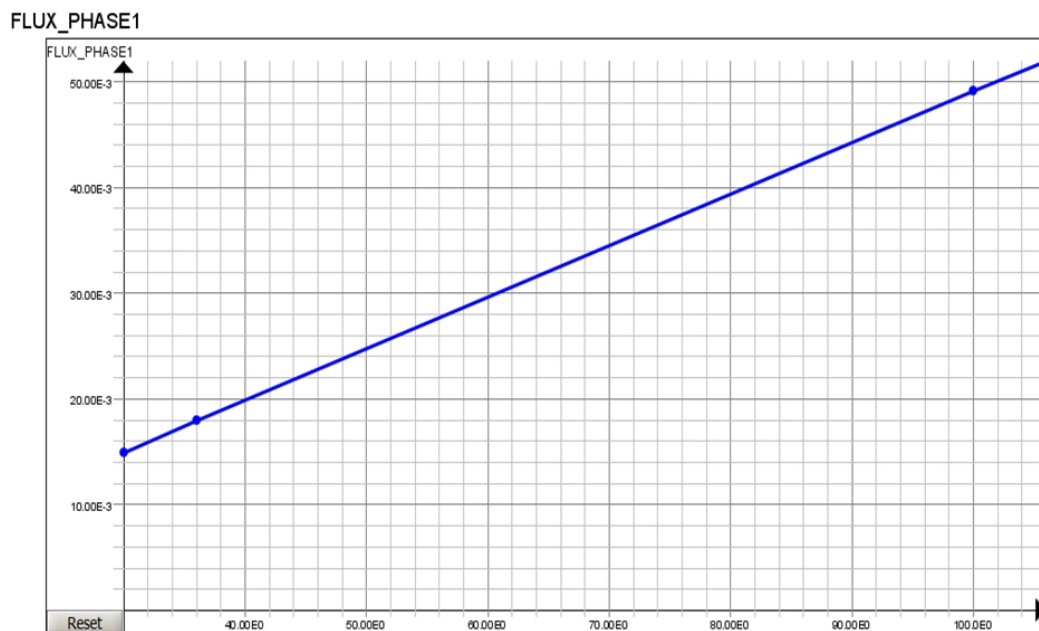
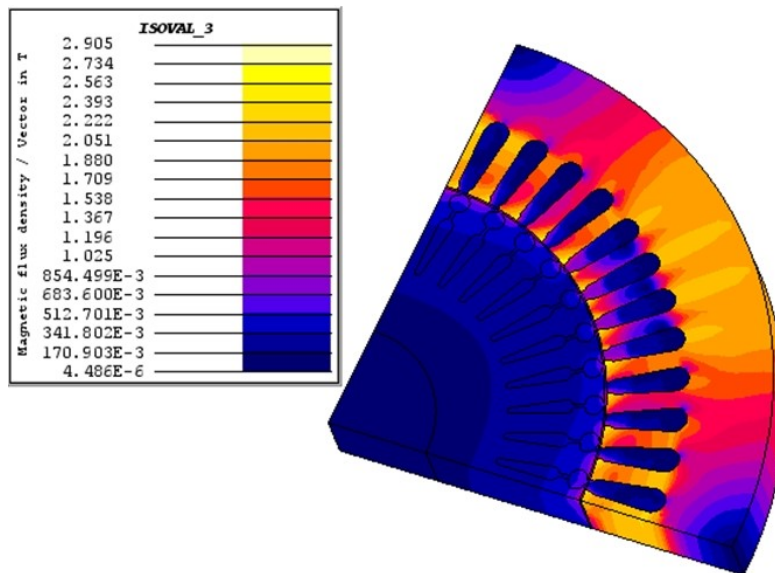
Example 2: Single-phased computation

This computation is focused on the self-inductivity, that is why only the first phase is modeled.



Example 3: Parametric computation taking into account the effect of magnetic saturation

In order to evaluate the influence of the magnetic saturation, the real B(H) characteristic of the materials is used.



Example 4: Computation taking into account the rotor influence

To take the rotor influence into account, the computations are made in all the regions of the asynchronous motor.

