16th Annual Meeting

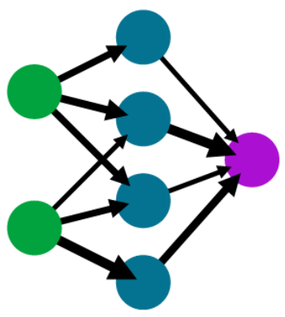
Design and optimization of medium-frequency and high-power transformer for aerospace applications using ANN

Daniel López Álamos

daniel.lopez.alamos@alumnos.upm.es/CEI

ABSTRACT

To achieve climate neutral air mobility by 2050 set by ACARE (Advisory Council for Aeronautics Research in Europe), requires the aviation industry to do a further step. In this context, HECATE (Hybrid ElectriC regional Aircraft distribution TEchnologies) project from Clean Aviation is born. CEI-UPM is working in the design and optimization of a magnetic components for the hybrid-electric propulsion system of the aircraft that is being designed by Collins Aerospace. Transfomer will be part of an isolated DC/DC converter in the KHVDC supply rail based on LLC and DAB converters. As the investigation of the E core transformer don't goes as expected because temperature increases too much, we are working in a U core transformer.

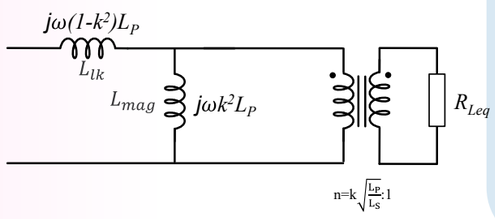


Vs

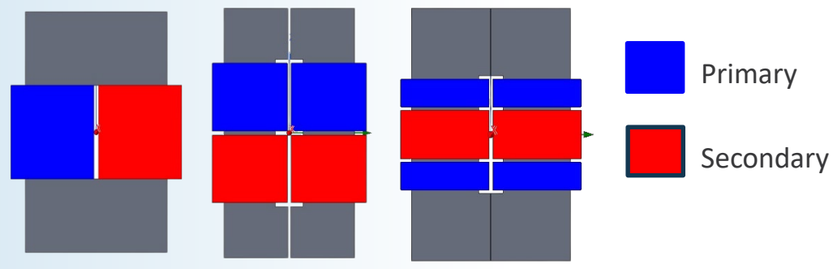
TRANSFORMER SPECIFICATIONS

Parameter	Value
Power	100 – 300 kW
Frequency	25 – 100 kHz
Primary voltage (Square)	800V
Turns ratio	6:4

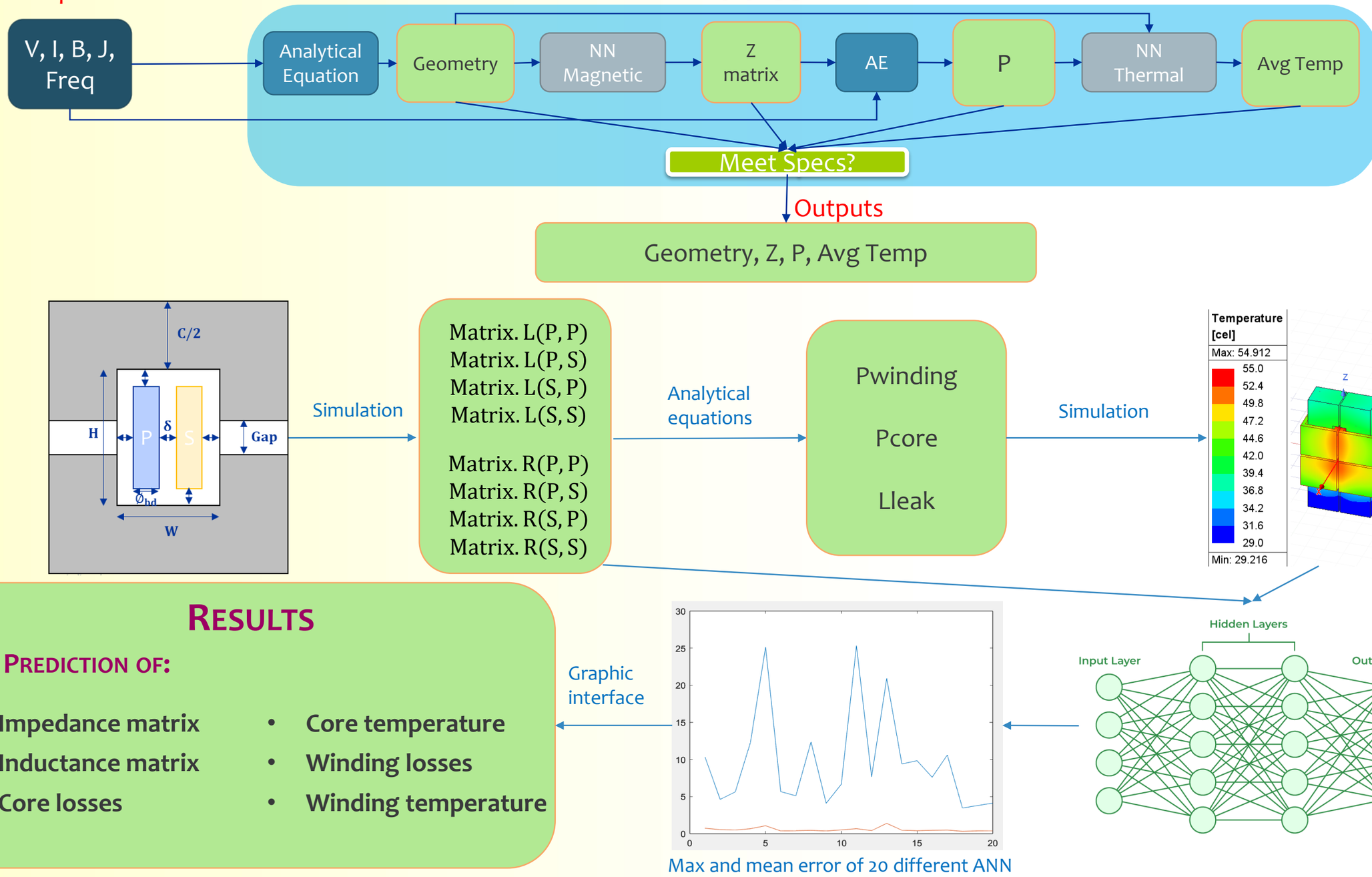
Parameter	Value
Primary current (senoidal)	150 – 300 A_{RMS}
Secondary current (senoidal)	200 – 400 A_{RMS}
Magnetizing Inductane	20 – 40 uH
Leakage inductance	1 – 5 uH



WINDING DISTRIBUTION



PROCESS

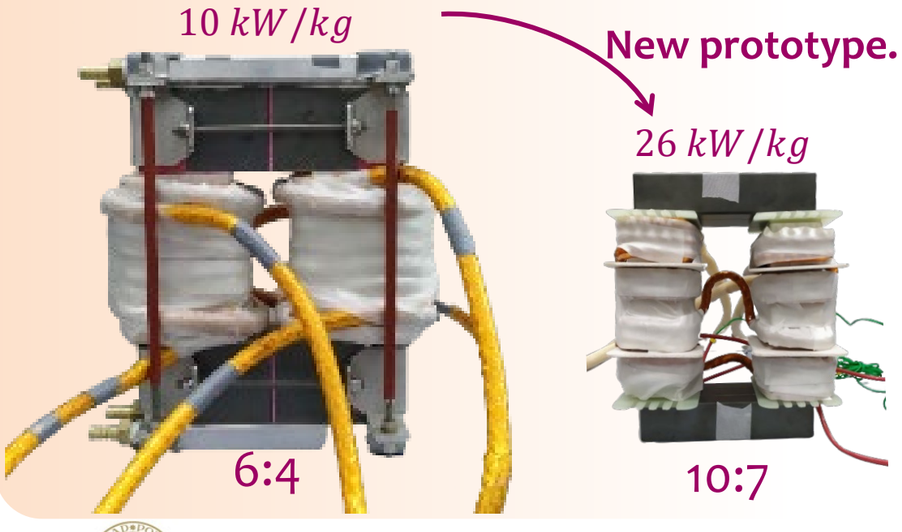


RESULTS

PREDICTION OF:

- Impedance matrix
- Inductance matrix
- Core losses
- Core temperature
- Winding losses
- Winding temperature

Prototype to beat



Conclusions

- Artificial Neural Networks are being completed.
- Mutual R values come out negative from simulations and the network does not understand them.
- Calculate the network using P instead of Z, since we have a database of Z and it can be easily manipulated to draw P.
- Do not take out the Z matrix, but calculate the equivalent model including R.
- Future: We want to beat the handmade prototype.

POLITÉCNICA

Project sponsored by HECATE

CLEAN AVIATION

Co-funded by the European Union

CEI UPM