TRANSFORMER ACADEMY

DESIGN OF DISTRIBUTION TRANSFORMERS

COURSE AUTHOR:
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MARIO SALANO was born in Genoa on 13 January 1950.

His expertise in the field of power transformers comes from well-established engineering skills acquired in “Salano transformers”, a renowned Italian company that manufactured line-frequency power transformers for Italian power utilities.

He is a freelancer in the field of Project Management, Transformers and Electronics, and Outreach Director in NIC-PMI. He has authored two books and has been collaborating with various publishing companies for the past four years.

His current interests include high-efficiency distribution transformers, the impact of non-linear loads on power transformers, novel materials for transformer cores and high-frequency power transformers for the use in conjunction with power electronics topologies.

WHAT MAKES THIS COURSE UNIQUE

The author's main intention is to provide a complete overview of transformer design by taking into account stakeholders' wishes and preferences.

TRANSFORMER ACADEMY

TARGET AUDIENCE

Transformer distribution professionals, electrical utilities and secondary medium voltage substation professionals, students and post-graduates, inspectors and supervisors, etc.

INTRODUCTORY / BASIC LEVEL

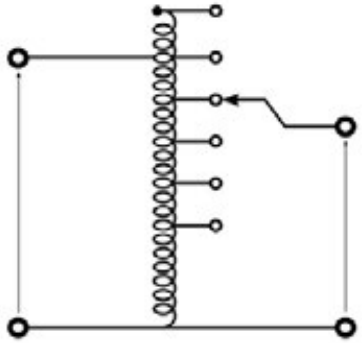
Fundamentals of the induction phenomenon at the basis of transformer operation

LESSON 1

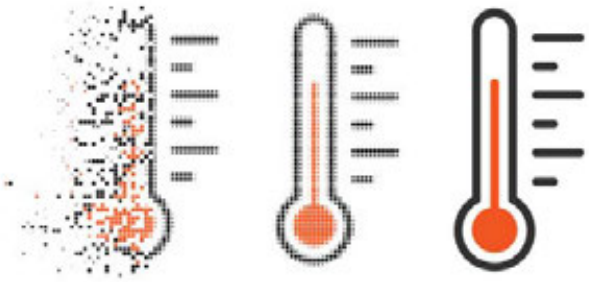
- Working principle of a transformer shown on the example of the behaviour of two close conducting wires in a mutual inductance environment; equations, voltage ratio, equivalent transformer.

LESSON 2

- Main types of physical transformers available on the market with the focus on line frequency transformers for energy distribution: constructive aspects with reference to design
- Design approaches through critical parameters for efficient results: power rating, rated voltage, insulation, short-circuit impedance, losses, temperature limits, cooling. A brief mention of optimum design with genetic algorithms which will be developed on the intermediate and mainly on the master's level



INTERMEDIATE LEVEL



LESSON 1

- Considerations of products that meet technical specifications overcoming business and social problems: concept applied to line frequency transformers

LESSON 2

- Construction elements for oil filled transformers: purpose analysis and considerations of which parts might be different to what is done today

LESSON 3

- Electromagnetic design of line frequency oil-filled distribution transformers with primary medium voltage (part 1)

LESSON 4

- Electromagnetic design of line frequency oil-filled plant transformers with primary high voltage (part 2): additional reference to optimum design

LESSON 5

- Thermal analysis for power transformers: the subject aims to show the links between losses and temperature in a transformer. What are the real requirements? Which links are there between costs, life and the environment? Design management in a few words is: REQUIREMENTS > PROOF OF CONCEPT > BUILD&TEST. Addressing the temperature issue. Some practical examples.

LESSON 6

- Transformers at no-load and on load: consequences of the green approach

LESSON 7

- Short circuit design

LESSON 8

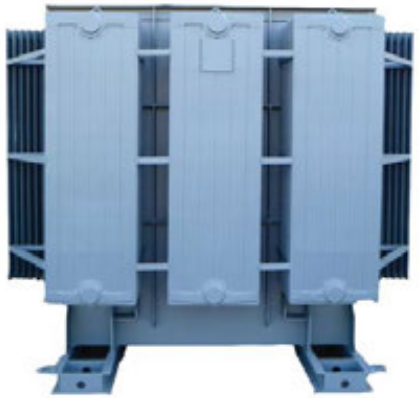
- Transients and risk analysis with the digital twin approach in support of design thinking
- Customized tanks that enable the connection of other components in the cabin
- Transformers for laminators with high short-circuit current
- Miscellanea about special transformers according to major special applications

LESSON 9

Practical transformer design calculation (elective)

LESSON 10

- Advanced materials for transformers (elective)



MASTER'S LEVEL

LESSON 1

- Amorphous Transformers

LESSON 2

- Cast Resin & Dry Type Transformers

LESSON 3

- Leakage inductance considerations and proximity losses

LESSON 4

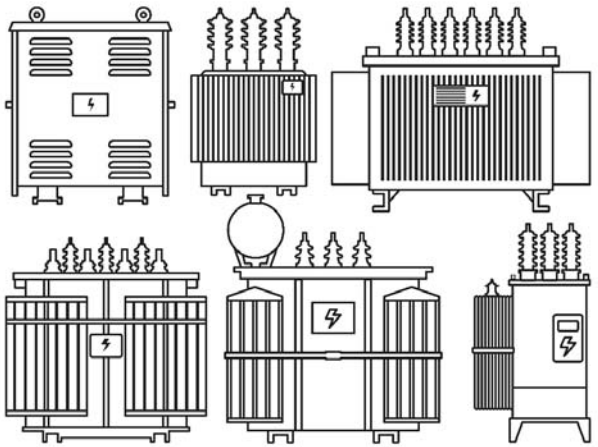
Advanced methodologies in custom design with special requirements

LESSON 5

- Effects of DC components in magnetization currents

LESSON 6

- Transformers in smart grids and renewables applications



LESSON 7

- Standard classes, norms, certifications for distribution and high power transformers

LESSON 8

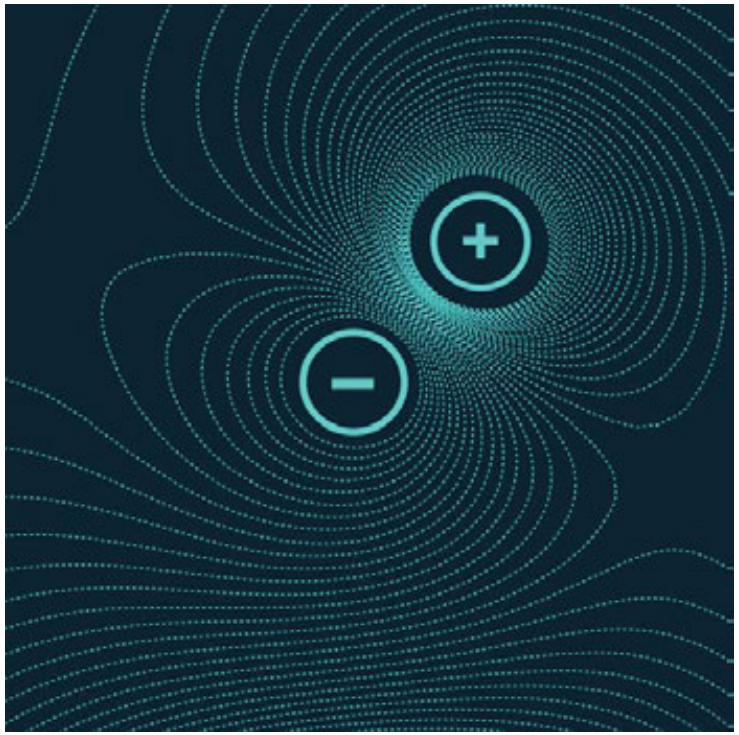
- Death valley in transformer projects: when requirements are too demanding

LESSON 9

- Optimum design with differential evolutions and genetic algorithms

LESSON 10

- The future of transformers and transformer design



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