Transformers ACADEMY

DESIGN OF DISTRIBUTION TRANSFORMERS

COURSE AUTHOR:
MARIO SALANO

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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.

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TARGET AUDIENCE

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

INTRODUCTORY / BASIC LEVEL

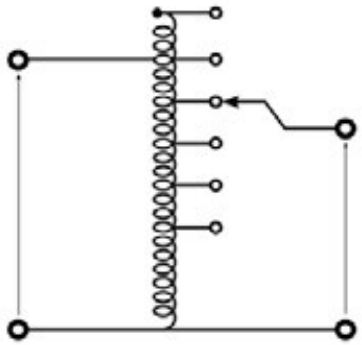
Fundamentals of the induction phenomenon at the basis of transformer operation

LESSON 1

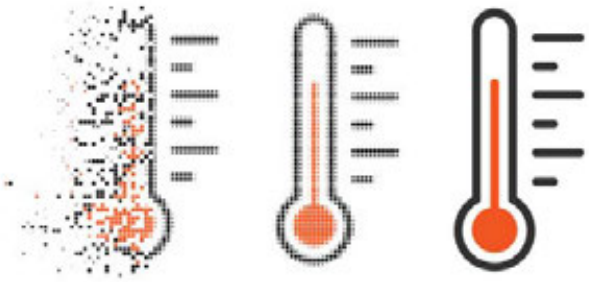
- Working principle of a transformer shown on the example of the behaviour of two close conducting wires in a mutual inductance environment; equations, voltage ratio, equivalent transformer.

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

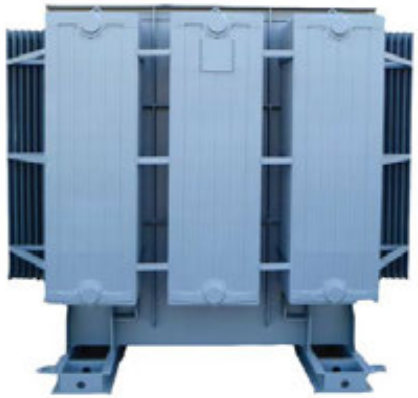
- Transients and risk analysis with the digital twin approach in support of design thinking
- Customized tanks that enable the connection of other components in the cabin
- Transformers for laminators with high short-circuit current
- Miscellanea about special transformers according to major special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

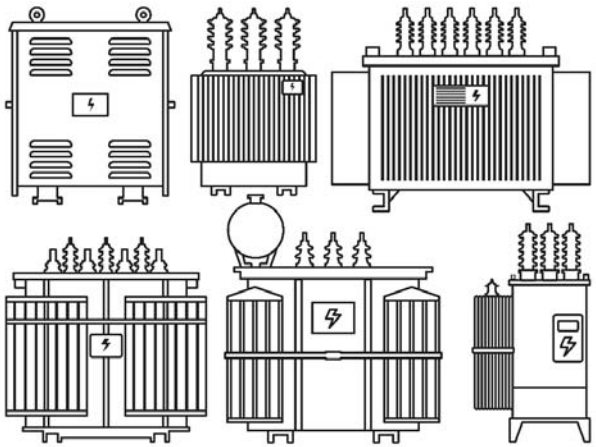
Advanced methodologies in custom design with special requirements

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

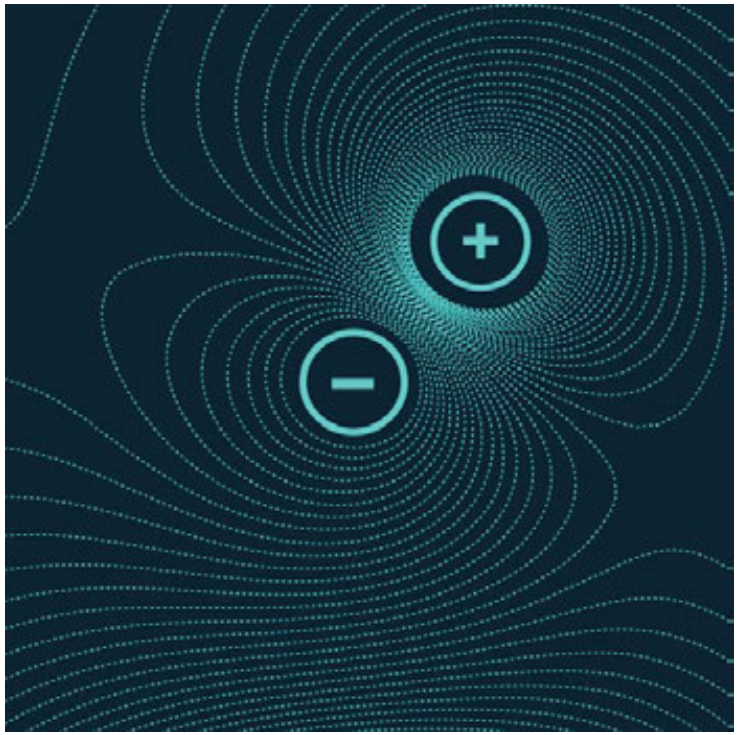
- Death valley in transformer projects: when requirements are too demanding

LESSON 9

- Optimum design with differential evolutions and genetic algorithms

LESSON 10

- The future of transformers and transformer design



info@merit-media.com

transformers-academy.com