

Title: Generators and transformers

Naslov: Generatorji in transformatorji (Podiplomski študijski program 2. stopnje Elektrotehnika,
Smer: Mehatronika, letnik:1, semester:1, šifra predmeta: 23)

Lecturer: doc. Dr. Maks Berlec, prof. Dr. Damijan Miljavec

Aim of the course:

The aim of the subject is to upgrade theoretical knowledge regarding the properties, design features and possibilities of using various types of transformers, power inductors and generators. The emphasis is on practical knowledge, used by future designers in the selection, sizing and use of these machines.

Required (pre)knowledge:

Electric machines - basics

Contents:

Losses in the core, coils and additional losses in the transformer and generator. The connections of transformer windings (Y, D, Z). Connection V (open delta). The problem of magnetization on the primary side of transformer in Yy connection. Special Z connection of coils on transformer primary side. Short-circuiting the transformer. Start-up phenomenon of transformer and power inductors. Heating and various types of cooling (ONAN, ONAF, OFAF ...). Autotransformer and three phase autotransformer. Atmospheric and switching over voltages. Regulating transformer. Grounding transformer. Phase shifting transformer. Transformer supplied by non-sinusoidal voltage. Transformer short-circuit damping. The laws of similarity. Power inductors for reactive power compensation. Basic tests of the transformer and generator. Protection elements for power transformers and generators. Transformer Isolation monitoring. Synchronous generator operating conditions (islands operation, operating on a rigid network, synchronous compensator). Unstable work of generator. Short circuit of synchronous generator. Synchronous reactance. Transient reactance. Sub-transient reactance. Diagnostic and insulation aging.

Selected references:

Bharat Heavy Electricals Limited: **Transformers**, McGraw-Hill, 2005

S.V. Kulkarni, S.A. Khaparde: **Transformer Engineering**, Marcel Dekker, Inc., 2004

James H. Harlow: **Electric Power Transformer Engineering**, CRC Press, 2003

Aa. Carlson, J. Fuhr, G. Schemel, F. Wegscheider: **Testing of Power Transformers**, Pro Print GmbH for ABB, Düsseldorf, 2003

Robert M. Del Vecchio et al.: **Transformer Design Principles: With Applications to Core-Form Power Transformers**, Gordon and Breach Science Publishers, 2001

Martin J. Heathcote: **J&P Transformer Book**, Newnes, (12th edition), 1998

Bernard Hochart: **Power Transformer Handbook**, Butterworth-Heinemann, 1999

S. Rao: **Power Transformers and Special Transformers**, Khanna Publishers, Delhi, 1996