ELEC0447 – Analysis of Electric Power and Energy Systems

Oral exam questions

2020-2021, January session

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You are assigned two questions, one from each of the lists below. Questions of list 1 will be accompanied by a short exercise (same type as the ones of the practice sessions).

List 1:

1. Describe what is a three-phase system, powers, voltages, currents, star and delta connections, how (and when) we can simplify the analysis to a per-phase analysis.
2. Describe what is the per-unit normalization principle, why it is useful, and how to apply it. Provide an example.
3. Describe how a transmission line can be modelled (distributed parameter representation and lumped model), what is the SIL and why it is useful.
4. Describe how a transformer can be modelled and its per unit representation, explain the phase shift in delta-star configurations.
5. Describe what is a tap changing transformer, what is a phase shifting transformer, how they work and how to include them in a power flow analysis.
6. State the model of a synchronous generator and describe its properties. Explain how a synchronous generator can be included in a power flow analysis.

List 2:

1. Explain the principle of the power flow analysis, derive the power flow equations, and sketch a solution method.
2. Describe the applications of HVDC systems and the main technologies. Describe the main components of a LCC link.
3. Describe the principles of thyristor valves and the operation of a LCC line. Explain briefly how a LCC link can be controlled and how to include it in a power flow analysis (basic model).
4. Describe the phenomenon of voltage instability, suggest countermeasures and discuss the possible impact of the energy transition on this phenomenon.
5. Describe the phenomenon of transient rotor angle instability, and explain de equal area criterion.
6. Explain the three levels of voltage control and the three levels of frequency control.

Write your answers on separate sheets per question, indicate the date, your name and student id on each sheet.