ELEC-E8422 An Introduction to Electric Energy

Exercise Session 8: Power Quality

EX1 Current Distortion

The current of a conductor is obtained as ($\omega = 2\pi50$):

i = 4 + 50 sin ωt + 30 sin 3ωt + 10 sin 5ωt + 5 sin 7ωt (A)

Calculate the total harmonic distortion of the current (THD)

EX2 Flicker

The voltage is of form u(t) = (170 + 2cos(0.2t)) cos ωt   ($\omega = 2\pi50$)

Calculate a) Flicker factor, b) voltage fluctuation (per unit), c) frequency of the fluctuation, d) assess the human tolerance to this flicker.

EX3 Voltage Sag

400 V network short circuit power is 1000 kVA (reactive). A 10 kW induction motor is connected. The motor takes 6-times nominal current when started (assume inductive current). Calculate the voltage drop as a) per unit value, b) per cent value, c) volts in line voltage, d) volts in phase voltage.

EX4 Harmonic Resonance

400 V substation is fed by a distribution transformer the inductance of which (together to primary side network) is 41,6 µH. In the substation, there is a 3-phase compensation capacitor of 250 kVAr. At which frequency the capacitor is in resonance with the network inductances?