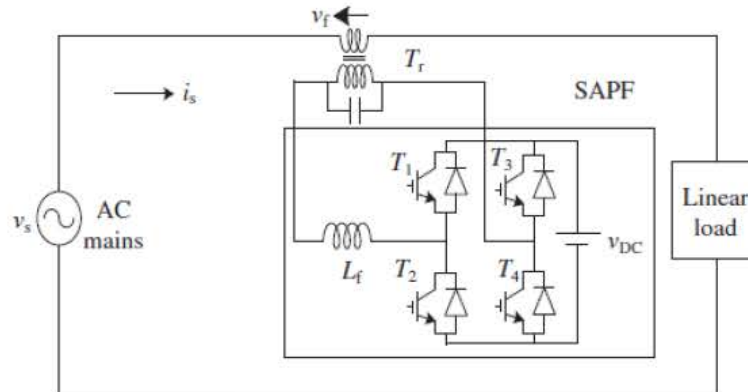


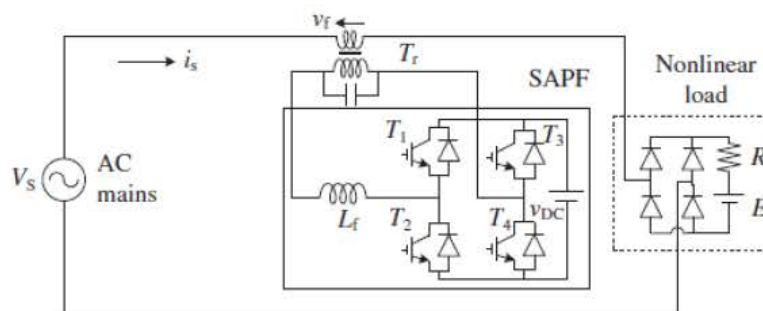
Electrical Power Quality (Assignment)

Q1: Design a single-phase series active power filter for filtering the voltage harmonics in a 220 V, 50 Hz AC mains (15% third, 10% fifth, and 5% seventh harmonics) present due to other loads and source impedance, before it is connected to a critical linear load of 5 kVA, 220 V, 50 Hz at 0.8 lagging power factor. If a single-phase VSC is used as a series APF, calculate (a) voltage and current ratings of the APF, (b) VA rating of the VSC of the series APF, and (c) interfacing inductance of the APF. Consider the switching frequency of 20 kHz, DC bus voltage of 200 V, and ripple current in the inductor is 10%.



Q2: A single-phase VSI with a square-wave AC output of 220V (rms) at 50 Hz is feeding a critical linear load of 3 kVA, 220 V, 50 Hz at 0.8 lagging power factor. Design a single-phase series active power filter for filtering the voltage harmonics in this system to eliminate voltage harmonics and to regulate fundamental 220V (rms) across the load. If a single-phase VSC is used as an APF, calculate (a) voltage rating of the APF, (b) current rating of the APF (c) VA rating of the VSC of the APF, and (d) interfacing inductance. Consider the switching frequency of 20 kHz, DC bus voltage of 200 V, and ripple current in the inductor is 5%.

Q3: A series active filter (consisting of a VSC with an AC series inductor and a DC bus capacitor) is used in series with single-phase AC supply of 220V at 50 Hz feeding a diode rectifier used for charging a battery of 252V at 15A average current to reduce the harmonics in AC mains current and to maintain almost UPF. Calculate (a) rms voltage at the input of the diode rectifier, (b) line current, (c) voltage rating of the APF, (d) current rating of the APF, (e) VA rating of the APF, (f) value of the DC bus voltage of the APF, and (g) value of the AC inductor of the APF. Consider the switching frequency of 20 kHz and ripple current in the inductor is 5%.



Q4: A series active filter (consisting of a VSC with an AC series inductor, a coupling transformer, and its DC bus connected to a battery functioning as the load) is used in series with single phase AC supply of 220V at 50 Hz feeding a diode rectifier used for charging a battery of 192V at 25A average current to reduce the harmonics in AC mains current and to maintain almost UPF. Calculate (a) rms voltage at the input of the diode rectifier, (b) line current, (c) voltage rating of the APF, (d) current rating of the APF, (e) VA rating of the APF, (f) value of the AC inductor, and (g) turns ratio of the coupling transformer. Consider the switching frequency of 20 kHz and ripple current in the inductor is 5%.