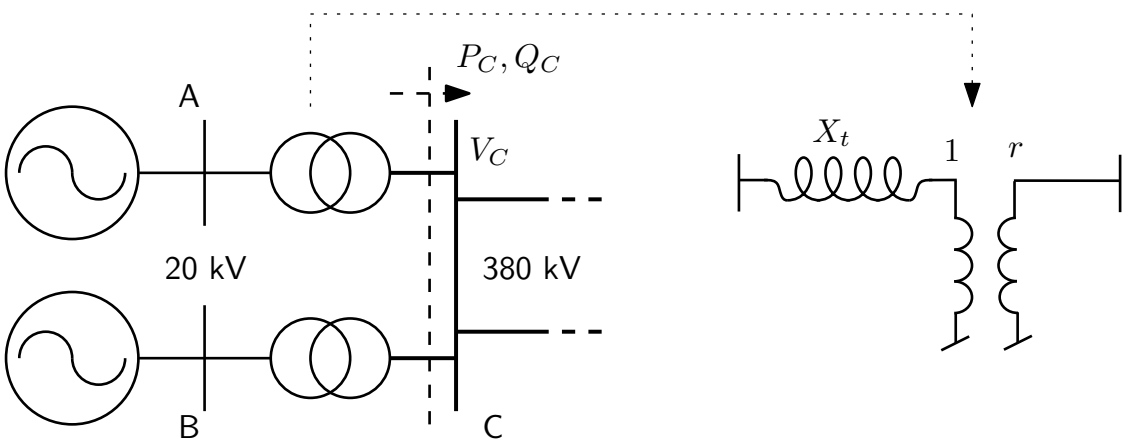
A power plant connected to a 380-kV network is made up of two identical generators with the following characteristics :

- nominal apparent power of synchronous machine : 250 MVA
- nominal voltage : 20 kV
- nominal power of turbine : 230 MW
- stator resistance : $R_a = 0.005$ pu
- synchronous reactance : $X_m = 2.15$ pu
- when the generator operates at no load (i.e. with stator opened), under its nominal voltage, the field voltage v_f is 500 V and the field current i_f is 670 A
- under the nominal voltage, the capability curves relative to respectively the nominal turbine power, the maximum rotor current and the maximum stator current cross each other at a single point.



Each transformer can be modeled as shown in the figure, with the following parameters :

- nominal apparent power : 250 MVA
- open-circuit voltages : 20 / 397.1 kV
- leakage reactance : $X_t = 0.15$ pu on the (20 kV, 250 MVA) base.

Consider the following operating point :

- voltage at bus C : 395.2 kV
- powers injected received at bus C : $P_C = 380$ MW, $Q_C = 70$ Mvar
- both machines produce the same powers.

Determine :

1. the voltage at bus A (in kV)
2. the reactive power produced by each machine (in Mvar)
3. the field voltage (in V) and field current (in A) of each machine
4. the power balance of each machine
5. the reactive power reserve of each machine (in Mvar). Neglect R_a

using the following base voltages and power : 20 kV, 380 kV, 100 MVA