Initial operating points and scenarios for the SIMULINK simulation of the 5-bus system

T. Van Cutsem

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Initial operating points

#	ARTERE data file	SIMULINK initialisation file	motor load at bus 4		exponential load at bus 5		generation at bus 2	
			P (MW)	Q (Mvar)	P (MW)	Q (Mvar)	P (MW)	V (pu)
1	lf1.dat	ini1.m	0	0	100	20	450	1.04
2	lf2.dat	ini2.m	0	0	400	80	350	1.01
3	lf3.dat	ini3.m	0	0	500	80	350	1.01
4	lf4.dat	ini4.m	600	100	500	80	300	1.00
5	lf5.dat	ini5.m	0	0	1200	600-600= 0*	300	1.01
6	lf6.dat	ini6.m	0	0	1500	750-600=150*	300	1.01
7	lf7.dat	ini7.m	0	0	1500	750-600=150*	450	1.01
8	lf8.dat	ini8.m	600	100	900	450-400= 50*	300	1.00

* the subtracted value corresponds to shunt compensation. The latter is specified in the load block of the SIMULINK model.
Do not forget to introduce the value by hand in the block !

Scenarios

#	initialisa-tion file	disturbance file	changes to be made to the disturbance file	simul.[1] time (s)	phenomena to be observed
1	ini1.m	net0.m	none	10	check that system is at equilibrium
2	ini1.m	net1.m	none	10	a fault is applied at t = 1.00 s at bus 3 and cleared by opening one circuit between buses 1 and 3 at t = 1.14 s. The fault thus lasts for 0.14 s. This is short enough to preserve stability and the system returns to a new equilibrium
3	ini1.m	net1.m	change time 1.14 into 1.15 at two places	10	the fault lasts for 0.15 s. This is too long and the generator looses synchronism. A case of **transient (angle) instability**
4	ini2.m	net2.m	none	15	a severe disturbance is considered, which consists of tripping the two circuits between buses 1 and 3, at t = 1 s. The generator and the load are thus "islanded". The power consumed by the load is 400 MW while the generator capacity is 450 MW. The governor is able to restore the frequency close to its nominal value, allowing operation of the island to continue
5	ini3.m	net2.m	none	10	same disturbance but here the power consumed by the load is 500 MW, which cannot be provided by the generator. Hence the frequency decay cannot be stopped. A case of **frequency instability**
6	ini4.m	net3.m	none	10	a severe disturbance is considered, which consists of tripping the generator as well as one circuit between buses 1 and 3, at t = 1 s. The motor (load at bus 4) stalls and the voltages collapse. A case of **short –term voltage instability** (by loss of short-term equilibrium)
7	ini4.m	net1.m	change time 1.14 into 1.15 at two places	10	a fault is applied at t = 1.00 s at bus 3 and cleared by opening one circuit between buses 1 and 3 at t = 1.15 s. The fault thus lasts for 0.12 s. This is short enough to preserve stability and the system returns to a new equilibrium

[1] Recommended value of simulation interval in order to avoid excessive time scale compression or partial output

8	ini4.m	net1.m	change time 1.14 into 1.16 at two places	10	the fault lasts for 0.16 s. This is too long and the motor (load at bus 4) stalls, causing voltage collapse. A case of **short-term voltage instability** (by lack of attraction towards post-disturbance short-term equilibrium)
9	ini5.m	net5.m	none	60	at t = 1 s, one circuit is tripped between buses 1 and 3. The automatic tap changer restores the voltage at the load bus within the deadband (2 steps). The system response is quite stable
10	ini6.m	net5.m	none	250	same disturbance but higher load. At t = 60 s, the overexcitation limiter of the generator is triggered and the generator voltage is no longer controlled. From there on, the automatic tap changer tries to restore the voltage at the load bus but without success. The voltage decreases monotonically. A case of **long-term voltage instability** (by loss of long-term equilibrium). The short-term dynamics remains stable. The system degradation stops when the tap changer reaches its limit
11	ini7.m	net5.m	none	180	similar to scenario 10 but here the long-term voltage instability triggers an **instability of the short-term dynamics** in the form of a loss of synchronism of the generator
12	ini8.m	net5.m	none	70	similar to scenario 11 but here the **instability of the short-term dynamics** takes on the form of both motor stalling and loss of synchronism