Data description

Modeling of smart inverter functions executed by photovoltaic systems for power flow analysis

This document contains the data and parameters for the simulations of the paper Modeling of Smart Inverter Functions Executed by Photovoltaic Systems for Power Flow Analysis.

For all simulations the parameters used were: $\epsilon_{partial} = 1e-2$; $\upsilon^{lim}_{partial} = 6$; $\epsilon = 1e-6$; and $\upsilon_{max} = 50$. And for DSF modeling: $\epsilon = 1e-6$; and $j_{max} = 50$, both for the power flow loop and the control loop.

Also, all simulations utilize the same PV system configuration of 44 MVA inverter operating with watt priority and 40 MWp of Kyocera KU330-8BCA module [1]. Others important parameters are: $N_{pp} = 2472$ modules; $N_{ss} = 49$ modules; $\eta = 0.98$; and coupling transformer's reactance of 0.6 pu. The VV and VW curve settings are given by Table 1 and 2, respectively.

Tabela 1: VV curve setting, adapted from IEEE1547-2018 std.

i	v_i (pu)	Q_i (% Q_{avail})
1	0,92	100 (cap.)
2	0,98	0
3	1,02	0
4	1.08	100 (ind.)

Tabela 2: VW curve setting, based on IEEE1547-2018 std recommendation.

i	v_i (pu)	P_i (% S_{nom})
P1	1,06	100 (cap.)
P2	1,1	0

Three test systems were used. Simulations with the simple single machine infinite bus (SMIB) address the proposed modeling validation. The SMIB has a reactance value of 0.01 pu, intending to simulate a strong network. In addition, the IEEE14 bus and mainly IEEE30 bus [2] were also simulated, with the only modification on voltage magnitudes to 1.10 pu on buses 1, 5, and 8 in IEEE30.

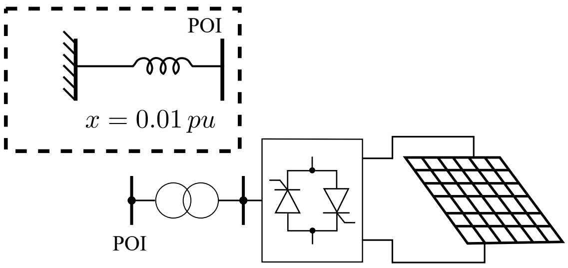

Figura 1: SMIB schematic.

Diverse scenarios and configurations were simulated, each one changing weather conditions, power factor setting, or reference bus voltage (V_1). Table 3 shows the eight configurations parameters closely analyzed. In most of them, only one generator or synchronous condenser is replaced for the PV system. However, IEEE30-PVs and IEEE14-PVs replace all of them, except the reference bus, for PV systems.

Referências

[1] Kyocera, *KU330-8BCA Datasheet*, 2024. URL: https://s3.amazonaws.com/ecodirect_docs/KYOCERA/Kyocera-KU-Series/KU300-80+Series-325-330w-specs.pdf.

Tabela 3: Main simulated configuration parameters.

	PV bus	V_1 (pu)	G (W/m^2)	T $(°C)$	Control
SMIB-VV	2	0,95	1000	25	VV
IEEE30-FPF-A	2	1,10	1000	25	FPF ($pf = 0{,}95$)
IEEE30-FPF-B	2	1,10	1000	25	FPF ($pf = 0{,}80$)
IEEE30-VV-A	2	1,10	1000	25	VV
IEEE30-VV-B	2	1,10	1150	25	VV
IEEE30-VW	2	1,10	1000	25	VW
IEEE30-PVs	2	1,10	800	40	FPF ($pf = 0{,}95$)
	5	-	900	48	VV
	8	-	1000	55	VW
	11	-	1200	60	FPF ($pf = 0{,}95$)
	13	-	920	50	VV
IEEE14-PVs	2	1,06	800	40	FPF ($pf = 0{,}95$)
	3	-	900	48	VV
	6	-	1000	55	VW
	8	-	920	50	VV

[2] R. D. Zimmerman, C. E. Murillo-Sanchez e R. J. Thomas, “MATPOWER: Steady-State Operations, Planning, and Analysis Tools for Power Systems Research and Education”, *IEEE Transactions on Power Systems*, vol. 26, pp. 12–19, 1 fev. de 2011.