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APPENDIX

APPENDIX A

Synchronous generator data

Machine parameter	Synchronous Generator		
Rated power (MW)	1	3	
Rated voltage (kV)	0.4	4.16	
Step up transformer(p.u)	0.08	0.08	
synchronous reactance (p.u)	X_d	2.838	1.305
	X_q	1.338	0.474
Transient reactance (p.u)	X_d'	0.2	0.202
	X_q'	0.2	0.243
Subtransient reactance (p.u)	X_d''	0.125	0.15
	X_q''	0.113	0.18
Leakage reactance (p.u)	X_l	0.15	0.17
Transient time constant (s)	T_d'	0.484	0.67
Subtransient time constant (s)	T_d''	0.007	0.015
	T_q''	0.005	0.015

Block Parameters: Synchronous Machine pu Standard X

Synchronous Machine (mask) (link)

Implements a 3-phase synchronous machine modelled in the dq rotor reference frame.

Stator windings are connected in wye to an internal neutral point.

Configuration Parameters | **Advanced** |

Nominal power, line-to-line voltage, frequency [Pn(VA) Vn(Vrms) fn(Hz)]:

[1.02e+004 460 60]

Reactances [X_d X_d' X_d'' X_q X_q' X_l] (pu):

[2.057 0.21 0.132 1.022 0.236 0.083]

d axis time constants:

q axis time constants:

Time constants [T_d' T_d'' T_q''] (s):

[0.012 0.003 0.003]

Stator resistance R_s (pu):

0.003

Inertia coefficient, friction factor, pole pairs [H(s) F(pu) p]:

[0.1608 0.04354 2]

Initial conditions [d_w (%) θ (deg) i_a, i_b, i_c (pu) ϕ_a, ϕ_b, ϕ_c (deg) v_f (pu)]:

[0 0 0 0 0 0 0 0 1]

Simulate saturation

Grid-connected photovoltaic data

Grid-connected photovoltaic parameter			
Rated power (MW)		1	3
Rated voltage (kV)		2.4	2.4
module in series		200	200
module in parallels		63	183
Boost converter	inductance (μH)	12000	12000
	capacitor (F)	4.8	4.8
PWM inverter	Switching frequency (kHz)	2	2
L&C filter	inductance (mH)	19	8
	capacitor (kvar)	30	30

APPENDIX B

23 bus distribution system

Line Data										
From	To	Length (km)	Phase	Library ref	R (Pos) (ohm/km)	X (Pos) (ohm/km)	R (Zero) (ohm/km)	X (Zero) (ohm/km)	Charging (Pos) (us/km)	Charging (Zero) (us/km)
201	202	2.0	ABC	185PIC	0.2107	0.3667	0.3913	1.3819	3.7069	1.6102
202	203	2.0	ABC	185PIC	0.2107	0.3667	0.3913	1.3819	3.7069	1.6102
203	204	1.0	ABC	185PIC	0.2107	0.3667	0.3913	1.3819	3.7069	1.6102
204	205	3.0	ABC	185PIC	0.2107	0.3667	0.3913	1.3819	3.7069	1.6102
205	206	3.0	ABC	185PIC	0.2107	0.3667	0.3913	1.3819	3.7069	1.6102
206	207	2.0	ABC	185PIC	0.2107	0.3667	0.3913	1.3819	3.7069	1.6102
207	208	4.0	ABC	185PIC	0.2107	0.3667	0.3913	1.3819	3.7069	1.6102
202	209	12.0	ABC	050ACSR	0.6667	0.4408	0.8490	1.6557	3.0384	1.4913
209	210	1.5	ABC	050ACSR	0.6667	0.4408	0.8490	1.6557	3.0384	1.4913
210	211	1.0	ABC	050ACSR	0.6667	0.4408	0.8490	1.6557	3.0384	1.4913
211	212	2.5	ABC	050ACSR	0.6667	0.4408	0.8490	1.6557	3.0384	1.4913
212	213	2.0	ABC	050PIC	0.8219	0.1730	1.0016	1.3884	3.3627	1.5309
213	214	1.0	ABC	050ACSR	0.6667	0.4408	0.8490	1.6557	3.0384	1.4913
214	215	1.5	ABC	050ACSR	0.6667	0.4408	0.8490	1.6557	3.0384	1.4913
215	216	2.5	ABC	050ACSR	0.6667	0.4408	0.8490	1.6557	3.0384	1.4913
209	92091	5.0	ABC	050ACSR	0.6667	0.4408	0.8490	1.6557	3.0384	1.4913
216	217	3.0	ABC	050ACSR	0.6667	0.4408	0.8490	1.6557	3.0384	1.4913
217	218	2.0	ABC	050ACSR	0.6667	0.4408	0.8490	1.6557	3.0384	1.4913
215	92151	5.0	CA	050ACSR	0.6667	0.4408	0.8490	1.6557	3.0384	1.4913
92151	92152	2.0	CA	050ACSR	0.6667	0.4408	0.8490	1.6557	3.0384	1.4913
203	92031	3.0	ABC	050ACSR	0.6667	0.4408	0.8490	1.6557	3.0384	1.4913
204	92041	1.0	ABC	050ACSR	0.6667	0.4408	0.8490	1.6557	3.0384	1.4913
200	201	1.0	ABC	185PIC	0.2107	0.3667	0.3913	1.3819	3.7069	1.6102
94041	94042	2.0	ABC	050ACSR	0.6667	0.4408	0.8490	1.6557	3.0384	1.4913

Load Data										
Node	Phase	Grounded	Bal	Connect	P(A) (kW)	Q(A) (kvar)	P(B) (kW)	Q(B) (kvar)	P(C) (kW)	Q(C) (kvar)
201	ABC	Yes	Yes	Wye	14.58	8.07				
92031	ABC	Yes	Yes	Wye	35	19.36				
92041	ABC	Yes	Yes	Wye	62.26	33.33				
206	ABC	Yes	Yes	Wye	72.92	40.34				
205	ABC	Yes	Yes	Wye	99.17	54.87				
207	ABC	Yes	Yes	Wye	43.75	24.21				
208	ABC	Yes	Yes	Wye	72.92	40.34				
92091	ABC	Yes	Yes	Wye	14.58	8.07				
209	ABC	Yes	Yes	Wye	14.58	8.07				
210	ABC	Yes	Yes	Wye	29.17	16.14				
211	ABC	Yes	Yes	Wye	14.58	8.07				
212	ABC	No	No	Delta	0.00	0.00			20.00	15.00
213	ABC	Yes	Yes	Wye	14.58	8.07				
214	ABC	Yes	Yes	Wye	46.67	25.82				
92151	CA	No	No	Delta	0.00	0.00			20.00	15.00
92152	CA	No	No	Delta	0.00	0.00			20.00	15.00
216	ABC	Yes	Yes	Wye	58.33	32.27				

BIOGRAPHY

Seihakkiry RANN was born on August, 31 1984 in Phnom Penh, the capital city of Cambodia. He received Bachelor of Engineering degree in 2007 electrical engineering from Institute of Technology of Cambodia (ITC), Phnom Penh, Cambodia. He was awarded AUN/SEED-Net scholarship to continue his study in Department of Electrical Engineering, Faculty of Engineering, Chulalongkorn University, Bangkok, Thailand in November 2007. His current research interests are in power quality and power system analysis.

