به نام خدا

تمرین کامپیوتری سوم تحلیل سیستم های انرژی الکتریکی ۲

تحلیل خطای نامتقارن با استفاده از نرم افزار DigSilent

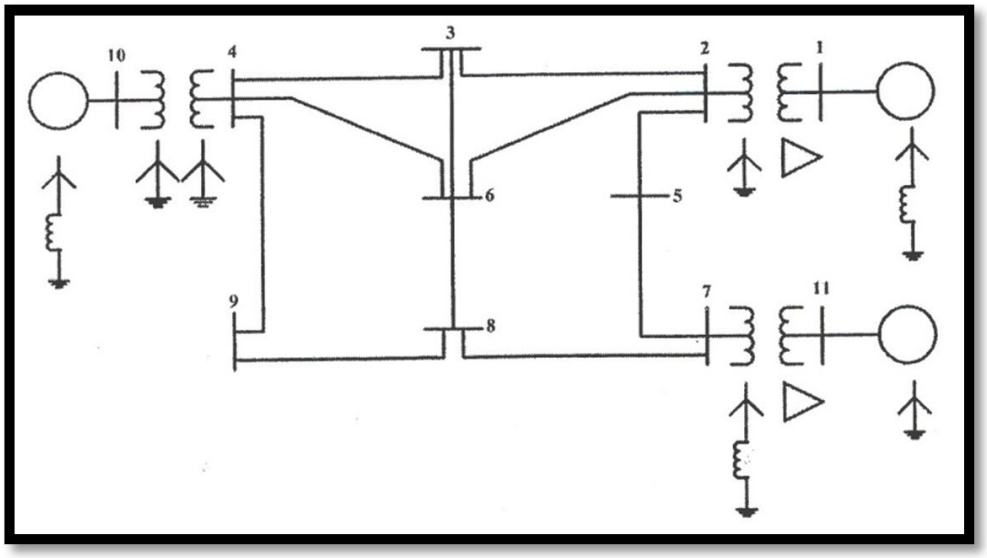
استاد درس: دکتر مسعود علی اکبر گلکار

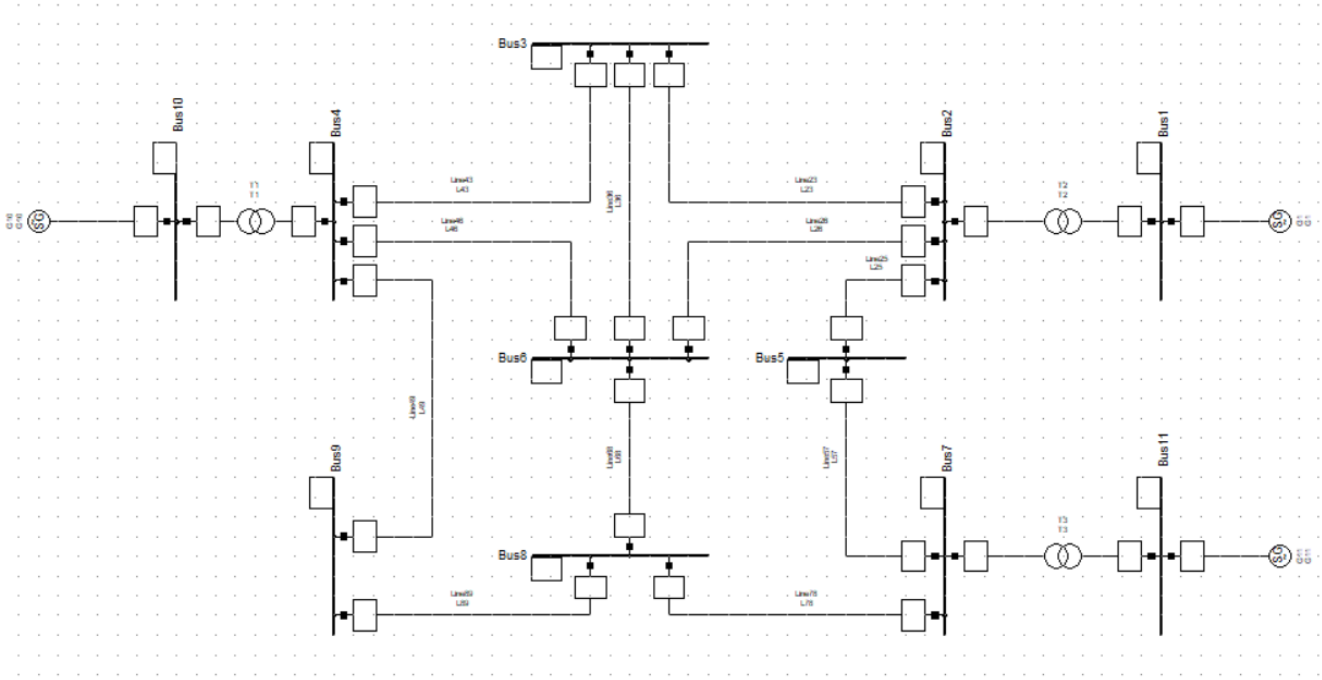
دانشجو: رضا آقاجری

شماره دانشجویی: ۹۸۱۹۵۸۳

زمستان ۱۴۰۱

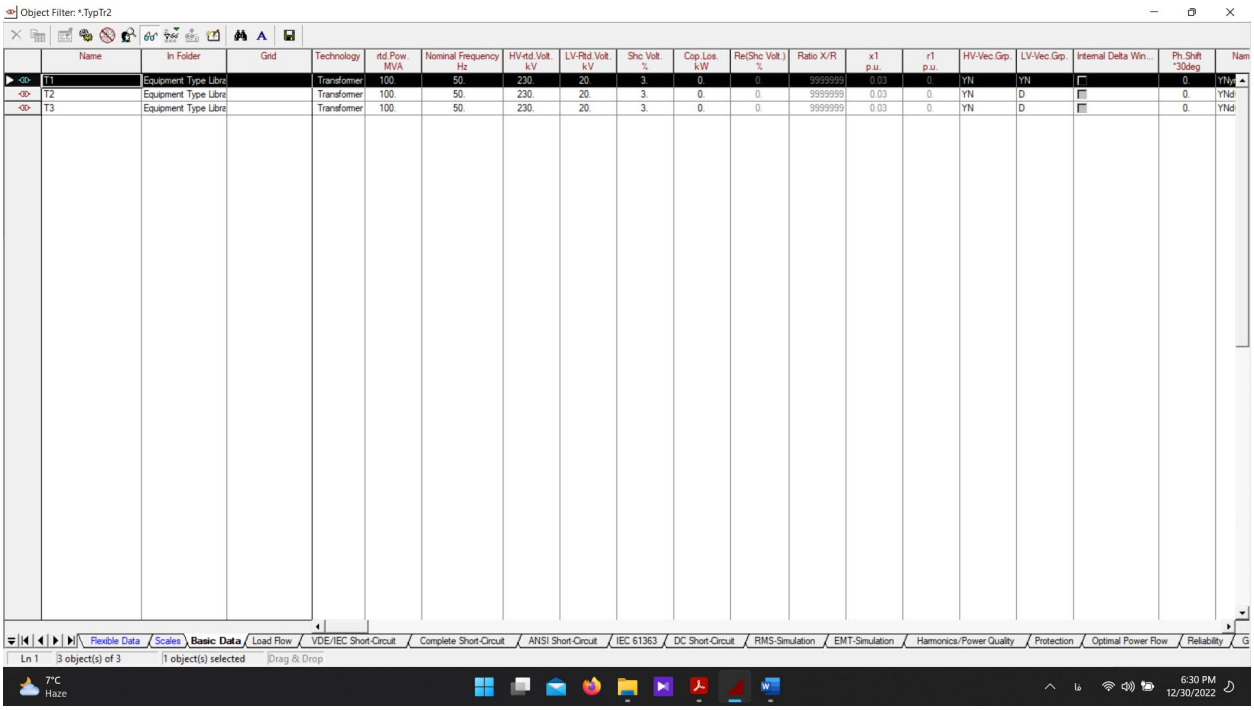
ابتدا شبکه مورد نظر را با استفاده از المان های موجود در برنامه دیگسایانت شبیه سازی میکنیم



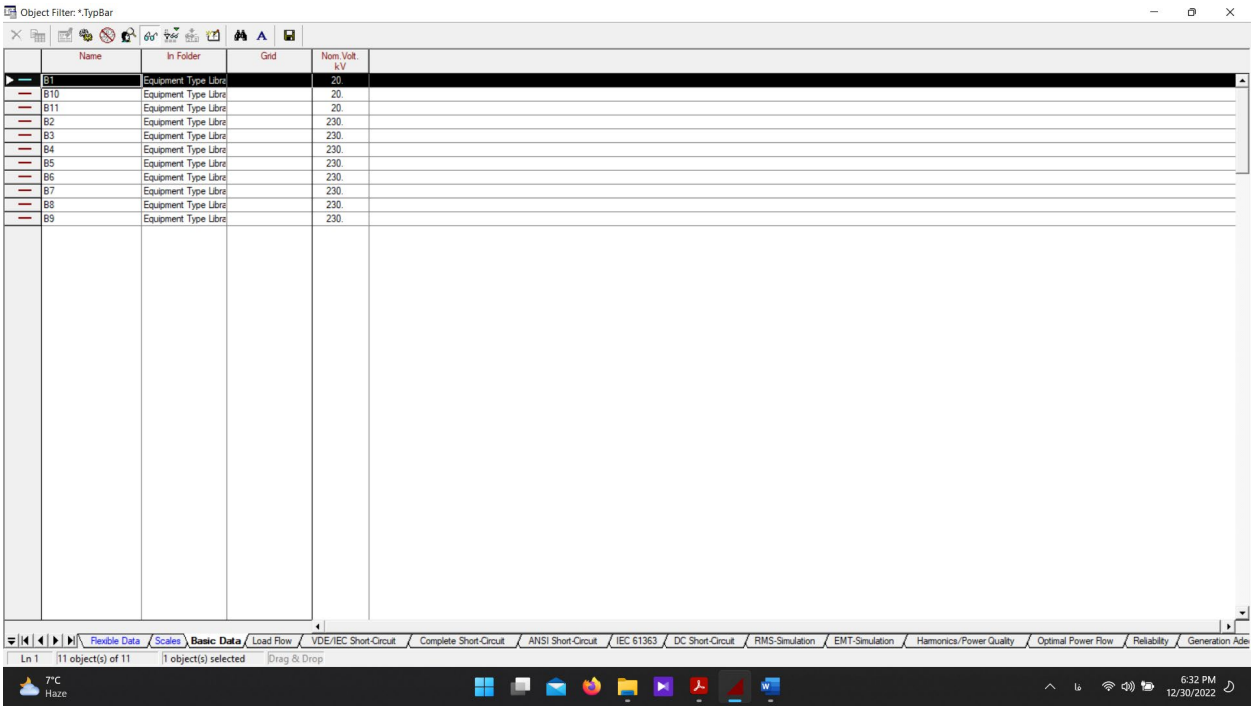


سپس به تعریف type برای هر المان و وارد کردن مقادیر مورد نظر می پردازیم.

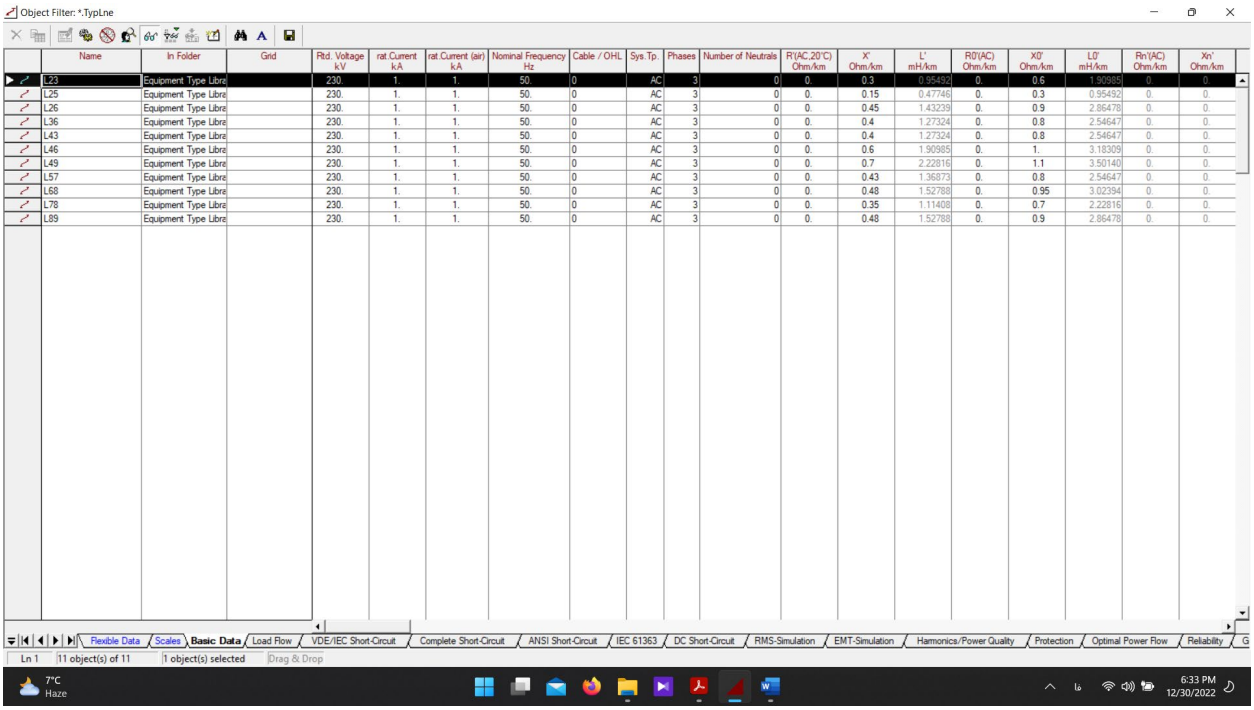
ترانسفورماتور ها:



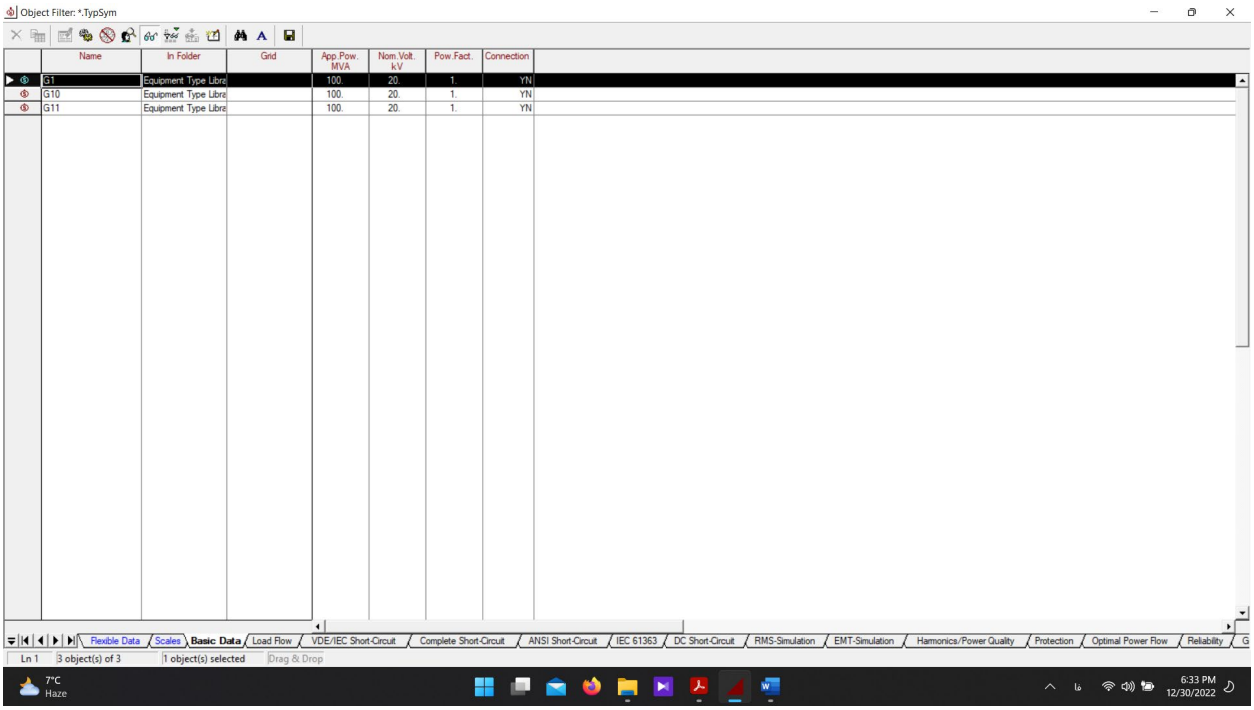
شین ها:



خطوط انتقال:



ژنراتور ها:



اکنون تست های مورد نظر سوال را روی شبکه اعمال میکنیم.

۱.خطای تکفاز با زمین در شین ۸:

		DIgSILENT PowerFactory 15.1.7	Project:
			Date: 12/30/2022

Fault Locations with Feeders
Short-Circuit Calculation / Method : VDE 0102 — 3-Phase Short-Circuit / Max. Short-Circuit Currents

Asynchronous Motors Always Considered	Grid Identification Automatic	Short-Circuit Duration Break Time 0.10 s Fault Clearing Time (Ith) 1.00 s
Decaying Aperiodic Component (idc) Using Method B	Conductor Temperature User Defined No	c-Voltage Factor User Defined No

Grid: Grid — System Stage: Grid — Annex: / 1

	rtd.V. [kV]	Voltage [kV]	[deg]	c-Factor	Sk" [MVA/MVA]	Ik" [kA/kA]	[deg]	ip [kA/kA]	Ib [kA]	Sb [MVA]	Ik [kA]	Ith [kA]
Bus8	230.00	0.00	0.00	1.10	1297.13 MVA	3.26 kA	-87.52	8.66 kA	2.69	1073.58	3.26	3.38
Line78	Bus7				593.10 MVA	1.49 kA	92.48	3.96 kA				
Line89	Bus9				250.24 MVA	0.63 kA	92.48	1.67 kA				
Line68	Bus6				453.78 MVA	1.14 kA	92.48	3.03 kA				

۲.خطای فاز به فاز در شین ۸:

		DIgSILENT PowerFactory 15.1.7	Project:
			Date: 12/30/2022

Fault Locations with Feeders
Short-Circuit Calculation / Method : VDE 0102 — 2-Phase Short-Circuit / Max. Short-Circuit Currents

Asynchronous Motors Always Considered	Grid Identification Automatic	Short-Circuit Duration Break Time 0.10 s Fault Clearing Time (Ith) 1.00 s
	Conductor Temperature User Defined No	c-Voltage Factor User Defined No

Grid: Grid — System Stage: Grid — Annex: / 1

		rtd.V. [kV]	Voltage [kV]	[deg]	c-Factor		Sk" [MVA/MVA]	Ik" [kA/kA]	[deg]	ip [kA/kA]	Ib [kA]	Sb [MVA]	EFF [-]
Bus8	A	230.00	143.69	1.26	1.10		0.00 MVA	0.00 kA	0.00	0.00 kA	0.00	0.00	1.00
	B		71.85	-178.74			380.72 MVA	2.87 kA	-178.74	7.63 kA	2.87	380.72	0.00
	C		71.85	-178.74			380.72 MVA	2.87 kA	1.26	7.63 kA	2.87	380.72	0.00
Line78		Bus7				A	8.60 MVA	0.06 kA	91.27	0.17 kA			
						B	166.69 MVA	1.26 kA	-0.22	3.34 kA			
						C	166.69 MVA	1.26 kA	-177.26	3.34 kA			
Line89		Bus9				A	4.52 MVA	0.03 kA	-88.73	0.09 kA			
						B	77.40 MVA	0.58 kA	2.93	1.55 kA			
						C	77.40 MVA	0.58 kA	179.59	1.55 kA			
Line68		Bus6				A	4.08 MVA	0.03 kA	-88.73	0.08 kA			
						B	136.74 MVA	1.03 kA	2.11	2.74 kA			
						C	136.74 MVA	1.03 kA	-179.60	2.74 kA			

۳.خطای فاز به فاز با زمین در شین ۸:

		DIgSILENT PowerFactory 15.1.7	Project:
			Date: 12/30/2022

Fault Locations with Feeders
Short-Circuit Calculation / Method : VDE 0102 — 2-Phase to Ground / Max. Short-Circuit Currents

Asynchronous Motors Always Considered	Grid Identification Automatic Conductor Temperature User Defined No	Short-Circuit Duration Break Time 0.10 s Fault Clearing Time (Ith) 1.00 s c-Voltage Factor User Defined No

Grid: Grid — System Stage: Grid — Annex: / 1

		rtd.V. [kV]	Voltage [kV]	[deg]	c-Factor	Sk" [MVA/MVA]	Ik" [kA/kA]	[deg]	ip [kA/kA]	Ib [kA]	Sb [MVA]	EFF [-]
Bus8	A	230.00	61.27	2.13	1.10	0.00 MVA	0.00 kA	0.00	0.00 kA	0.00	0.00	0.42
	B		0.00	-120.00		597.55 MVA	4.50 kA	131.16	11.97 kA	4.50	597.55	0.00
	C		0.00	120.00		597.55 MVA	4.50 kA	53.11	11.97 kA	4.50	597.55	0.00
Line78		Bus7										
	A					24.12 MVA	0.18 kA	-87.87	0.48 kA			
	B					294.11 MVA	2.21 kA	-52.58	5.89 kA			
	C					294.11 MVA	2.21 kA	-123.16	5.89 kA			
Line89		Bus9										
	A					12.15 MVA	0.09 kA	92.13	0.24 kA			
	B					105.49 MVA	0.79 kA	-43.55	2.11 kA			
	C					105.49 MVA	0.79 kA	-132.18	2.11 kA			
Line68		Bus6										
	A					11.97 MVA	0.09 kA	92.12	0.24 kA			
	B					199.25 MVA	1.50 kA	-46.14	3.99 kA			
	C					199.25 MVA	1.50 kA	-129.60	3.99 kA			

برای بخش ۵ سوال میتوانیم از استاندارد های موجود در نرم افزار استفاده کنیم

برای نیم سیکل، چهار سیکل و سی سیکل خطای تکفاز با زمین در شین ۸ به ترتیب داریم:

IEC 60609

		DIgSILENT PowerFactory 15.1.7	Project:
			Date: 12/30/2022

Fault Locations with Feeders
Short-Circuit Calculation / Method : IEC 60909 — Single Phase to Ground / Max. Short-Circuit Currents

Asynchronous Motors Always Considered	Grid Identification Automatic Conductor Temperature User Defined No	Short-Circuit Duration Break Time 0.10 s Fault Clearing Time (Ith) 1.00 s c-Voltage Factor User Defined No

Grid: Grid — System Stage: Grid — Annex: / 1

		rtd.V. [kV]	Voltage [kV]	[deg]	c-Factor	Sk" [MVA/MVA]	Ik" [kA/kA]	[deg]	ip [kA/kA]	Ib [kA]	Sb [MVA]	EFF [-]
Bus8	A	230.00	0.00	0.00	1.10	599.87 MVA	4.52 kA	-88.85	12.01 kA	4.52	599.87	0.00
	B		126.19	-97.88		0.00 MVA	0.00 kA	0.00	0.00 kA	0.00	0.00	0.88
	C		126.19	100.17		0.00 MVA	0.00 kA	0.00	0.00 kA	0.00	0.00	0.87
Line78		Bus7			A	283.63 MVA	2.14 kA	91.15	5.68 kA			
					B	22.14 MVA	0.17 kA	73.32	0.44 kA			
					C	22.14 MVA	0.17 kA	108.97	0.44 kA			
Line89		Bus9			A	111.16 MVA	0.84 kA	91.15	2.23 kA			
					B	11.31 MVA	0.09 kA	-107.21	0.23 kA			
					C	11.31 MVA	0.09 kA	-70.50	0.23 kA			
Line68		Bus6			A	205.09 MVA	1.54 kA	91.15	4.11 kA			
					B	10.83 MVA	0.08 kA	-106.13	0.22 kA			
					C	10.83 MVA	0.08 kA	-71.58	0.22 kA			

ANSI

		DIgSILENT PowerFactory 15.1.7	Project:
			Date: 12/30/2022

Fault Locations with Feeders — Complete Report —
Short-Circuit Calculation / Method : ANSI — Single Phase to Ground

Pre-fault Voltage 1.00 p.u. Consider Transformer Taps No	Fault Impedance Resistance, Rf 0.00 Ohm Reactance, Xf 0.00 Ohm	NACD Mode Interpolated Currents/Voltages for LV/Interrupting

Grid: Grid — System Stage: Grid — Annex: / 1

		Rated Voltage [kV]	Equivalent Impedance R[Ohm]	X[Ohm]	Symmetrical Current [kA]	(E/Z) [deg]	Apparent Power [MVA]	X/R ratio	Asym.RMS X/R based [kA]	Asym.Peak X/R based [kA]	Sym.Base [kA]	Tot.Base [kA]
Bus8		230.00										
	Mom.Duty		0.950	40.761	4.513	-89.13	599.316	68.961	7.587	8.925		
	Zero-Seq		0.216	8.022						2 cycles	5.386	7.263
	Neg.-Seq		0.170	39.474						3 cycles	5.692	6.782
	Int.Duty		0.950	40.761	4.513	-89.13	599.316	68.961		5 cycles	5.826	6.384
	Zero-Seq		0.216	8.022						8 cycles	6.016	6.018
	Neg.-Seq		0.170	39.474								
	30-cycle		0.216	8.022	3.762	-89.06	499.506					
	Zero-Seq		0.216	8.022								
	Neg.-Seq		0.170	39.474								
Line78				Mom.Duty	2.134	90.88	283.310		7.587	8.925		
				Int.Duty	2.134	90.88	283.310			2 cycles	5.386	7.263
				30-cycle	1.778	90.95	236.118			3 cycles	5.692	6.782
										5 cycles	5.826	6.384
										8 cycles	6.016	6.018
Line89				Mom.Duty	0.836	90.84	111.069		7.587	8.925		
				Int.Duty	0.836	90.84	111.069			2 cycles	5.386	7.263
				30-cycle	0.697	90.91	92.575			3 cycles	5.692	6.782
										5 cycles	5.826	6.384
										8 cycles	6.016	6.018
Line68				Mom.Duty	1.543	90.86	204.937		7.587	8.925		
				Int.Duty	1.543	90.86	204.937			2 cycles	5.386	7.263
				30-cycle	1.286	90.93	170.812			3 cycles	5.692	6.782
										5 cycles	5.826	6.384
										8 cycles	6.016	6.018

COMPLETE

		DIgSILENT PowerFactory 15.1.7	Project:
			Date: 12/30/2022

Fault Locations with Feeders
Short-Circuit Calculation / Method : complete — Single Phase to Ground / Max. Short-Circuit Currents

Short-Circuit Duration		Fault Impedance	
Break Time	0.10 s	Resistance, Rf	0.00 Ohm
Fault Clearing Time (Ith)	1.00 s	Reactance, Xf	0.00 Ohm

Grid: Grid — System Stage: Grid — Annex: / 1

		rtd.V. [kV]	Voltage [kV]	Voltage [deg]	c-Factor	Sk" [MVA/MVA]	Ik" [kA/kA]	Ik" [deg]	Ik' [kA]	ip [kA/kA]	Ib [kA]	ib [kA]	EFF [-]
Bus8	A	230.00	0.00	0.00	1.00	599.33 MVA	4.51 kA	-90.0	3.76	12.77 kA	3.82	11.79	0.00
	B		114.76	-99.08		0.00 MVA	0.00 kA	0.0	0.00	0.00 kA	0.00	0.00	0.88
	C		114.76	99.08		0.00 MVA	0.00 kA	0.0	0.00	0.00 kA	0.00	0.00	0.88
Line78		Bus7			A	283.31 MVA	2.13 kA	90.0	1.78	6.03 kA			
					B	22.05 MVA	0.17 kA	72.1	0.14	0.47 kA			
					C	22.05 MVA	0.17 kA	107.9	0.14	0.47 kA			
Line89		Bus9			A	111.07 MVA	0.84 kA	90.0	0.70	2.37 kA			
					B	11.28 MVA	0.08 kA	-108.4	0.07	0.24 kA			
					C	11.28 MVA	0.08 kA	-71.6	0.07	0.24 kA			
Line68		Bus6			A	204.94 MVA	1.54 kA	90.0	1.29	4.37 kA			
					B	10.77 MVA	0.08 kA	-107.3	0.07	0.23 kA			
					C	10.77 MVA	0.08 kA	-72.7	0.07	0.23 kA			

برای نیم سیکل، چهار سیکل و سی سیکل خطای فاز به فاز در شین ۸ به ترتیب داریم:

IEC 60609

		DIgSILENT PowerFactory 15.1.7	Project:
			Date: 12/30/2022

Fault Locations with Feeders
Short-Circuit Calculation / Method : IEC 60909 — 2-Phase Short-Circuit / Max. Short-Circuit Currents

Asynchronous Motors Always Considered	Grid Identification Automatic Conductor Temperature User Defined No	Short-Circuit Duration Break Time 0.10 s Fault Clearing Time (Ith) 1.00 s c-Voltage Factor User Defined No

Grid: Grid — System Stage: Grid — Annex: / 1

		rtd.V. [kV]	Voltage [kV]	[deg]	c-Factor	Sk" [MVA/MVA]	Ik" [kA/kA]	[deg]	ip [kA/kA]	Ib [kA]	Sb [MVA]	EFF [-]
Bus8	A	230.00	143.69	1.26	1.10	0.00 MVA	0.00 kA	0.00	0.00 kA	0.00	0.00	1.00
	B		71.85	-178.74		380.72 MVA	2.87 kA	-178.74	7.63 kA	2.87	380.72	0.00
	C		71.85	-178.74		380.72 MVA	2.87 kA	1.26	7.63 kA	2.87	380.72	0.00
Line78	Bus7				A	8.60 MVA	0.06 kA	91.27	0.17 kA			
					B	166.69 MVA	1.26 kA	-0.22	3.34 kA			
					C	166.69 MVA	1.26 kA	-177.26	3.34 kA			
Line89	Bus9				A	4.52 MVA	0.03 kA	-88.73	0.09 kA			
					B	77.40 MVA	0.58 kA	2.93	1.55 kA			
					C	77.40 MVA	0.58 kA	179.59	1.55 kA			
Line68	Bus6				A	4.08 MVA	0.03 kA	-88.73	0.08 kA			
					B	136.74 MVA	1.03 kA	2.11	2.74 kA			
					C	136.74 MVA	1.03 kA	-179.60	2.74 kA			

ANSI

		DIgSILENT PowerFactory 15.1.7	Project:
			Date: 12/30/2022

Fault Locations with Feeders — Complete Report —
Short-Circuit Calculation / Method : ANSI — 2-Phase Short-Circuit

Pre-fault Voltage 1.00 p.u. Consider Transformer Taps No	Fault Impedance Resistance, Rf 0.00 Ohm Reactance, Xf 0.00 Ohm	NACD Mode Interpolated Currents/Voltages for LV/Interrupting

Grid: Grid — System Stage: Grid — Annex: / 1

		Rated Voltage [kV]	Equivalent Impedance R[Ohm]	X[Ohm]	Symmetrical Current (E/Z) [kA]	[deg]	Apparent Power [MVA]	X/R ratio	Asym.RMS X/R based [kA]	Asym.Peak X/R based [kA]			
Bus8		230.00										Sym.Base [kA]	Tot.Base [kA]
	Mom.Duty		0.950	40.761	2.866	-179.20	380.619	71.980	4.824	5.671			
	Zero-Seq		0.216	8.022							2 cycles	3.300	4.442
	Neg.-Seq		0.170	39.474							3 cycles	3.393	4.066
	Int.Duty		0.950	40.761	2.866	-179.20	380.619	71.980			5 cycles	3.449	3.746
	Zero-Seq		0.216	8.022							8 cycles	3.489	3.461
	Neg.-Seq		0.170	39.474									
	30-cycle		0.216	8.022	2.350	-179.11	312.034						
	Zero-Seq		0.216	8.022									
	Neg.-Seq		0.170	39.474									
Line78			Mom.Duty		1.255	-0.69	166.669		4.824	5.671			
			Int.Duty		1.255	-0.69	166.669			2 cycles		3.300	4.442
			30-cycle		1.029	-0.60	136.628			3 cycles		3.393	4.066
										5 cycles		3.449	3.746
										8 cycles		3.489	3.461
Line89			Mom.Duty		0.583	179.14	77.381		4.824	5.671			
			Int.Duty		0.583	179.14	77.381			2 cycles		3.300	4.442
			30-cycle		0.478	179.23	63.441			3 cycles		3.393	4.066
										5 cycles		3.449	3.746
										8 cycles		3.489	3.461
Line68			Mom.Duty		1.029	179.95	136.708		4.824	5.671			
			Int.Duty		1.029	179.95	136.708			2 cycles		3.300	4.442
			30-cycle		0.844	-179.96	112.079			3 cycles		3.393	4.066
										5 cycles		3.449	3.746
										8 cycles		3.489	3.461

COMPLETE

		DIgSILENT PowerFactory 15.1.7	Project:
			Date: 12/30/2022

Fault Locations with Feeders
Short-Circuit Calculation / Method : complete — 2-Phase Short-Circuit / Max. Short-Circuit Currents

Short-Circuit Duration		Fault Impedance	
Break Time	0.10 s	Resistance, Rf	0.00 Ohm
Fault Clearing Time (Ith)	1.00 s	Reactance, Xf	0.00 Ohm

Grid: Grid — System Stage: Grid — Annex: / 1

		rtd.V. [kV]	Voltage [kV]	[deg]	c-Factor		Sk" [MVA/MVA]	Ik" [kA/kA]	[deg]	Ik' [kA]	ip [kA/kA]	Ib [kA]	ib [kA]	EFF [-]
Bus8	A	230.00	130.66	-0.00	1.00		0.00 MVA	0.00 kA	0.0	0.00	0.00 kA	0.00	0.00	1.00
	B		65.33	180.00			380.63 MVA	2.87 kA	-180.0	2.35	8.11 kA	2.39	7.44	0.00
	C		65.33	180.00			380.63 MVA	2.87 kA	0.0	2.35	8.11 kA	2.39	7.44	0.00
Line78		Bus7				A	8.60 MVA	0.06 kA	90.0	0.05	0.18 kA			
						B	166.66 MVA	1.26 kA	-1.5	1.03	3.55 kA			
						C	166.66 MVA	1.26 kA	-178.5	1.03	3.55 kA			
Line89		Bus9				A	4.52 MVA	0.03 kA	-90.0	0.03	0.10 kA			
						B	77.37 MVA	0.58 kA	1.7	0.48	1.65 kA			
						C	77.37 MVA	0.58 kA	178.3	0.48	1.65 kA			
Line68		Bus6				A	4.08 MVA	0.03 kA	-90.0	0.03	0.09 kA			
						B	136.70 MVA	1.03 kA	0.9	0.84	2.91 kA			
						C	136.70 MVA	1.03 kA	179.1	0.84	2.91 kA			

برای نیم سیکل، چهار سیکل و سی سیکل خطای فاز به فاز با زمین در شین ۸ به ترتیب داریم:

IEC 60609

		DIgSILENT PowerFactory 15.1.7	Project:
			Date: 12/30/2022

Fault Locations with Feeders
Short-Circuit Calculation / Method : IEC 60909 — 2-Phase to Ground / Max. Short-Circuit Currents

Asynchronous Motors Always Considered	Grid Identification Automatic Conductor Temperature User Defined No	Short-Circuit Duration Break Time 0.10 s Fault Clearing Time (Ith) 1.00 s c-Voltage Factor User Defined No

Grid: Grid — System Stage: Grid — Annex: / 1

		rtd.V. [kV]	Voltage [kV]	[deg]	c-Factor	Sk" [MVA/MVA]	Ik" [kA/kA]	[deg]	ip [kA/kA]	Ib [kA]	Sb [MVA]	EFF [-]
Bus8	A	230.00	61.27	2.13	1.10	0.00 MVA	0.00 kA	0.00	0.00 kA	0.00	0.00	0.42
	B		0.00	-120.00		597.55 MVA	4.50 kA	131.16	11.97 kA	4.50	597.55	0.00
	C		0.00	120.00		597.55 MVA	4.50 kA	53.11	11.97 kA	4.50	597.55	0.00
Line78		Bus7										
	A					24.12 MVA	0.18 kA	-87.87	0.48 kA			
	B					294.11 MVA	2.21 kA	-52.58	5.89 kA			
	C					294.11 MVA	2.21 kA	-123.16	5.89 kA			
Line89		Bus9										
	A					12.15 MVA	0.09 kA	92.13	0.24 kA			
	B					105.49 MVA	0.79 kA	-43.55	2.11 kA			
	C					105.49 MVA	0.79 kA	-132.18	2.11 kA			
Line68		Bus6										
	A					11.97 MVA	0.09 kA	92.12	0.24 kA			
	B					199.25 MVA	1.50 kA	-46.14	3.99 kA			
	C					199.25 MVA	1.50 kA	-129.60	3.99 kA			

ANSI

		DIgSILENT PowerFactory 15.1.7	Project:
			Date: 12/30/2022

Fault Locations with Feeders — Complete Report —
Short-Circuit Calculation / Method : ANSI — 2-Phase Short-Circuit

Pre-fault Voltage 1.00 p.u. Consider Transformer Taps No	Fault Impedance Resistance, Rf 0.00 Ohm Reactance, Xf 0.00 Ohm	NACD Mode Interpolated Currents/Voltages for LV/Interrupting

Grid: Grid — System Stage: Grid — Annex: / 1

		Rated Voltage [kV]	Equivalent Impedance R[Ohm]	X[Ohm]	Symmetrical Current (E/Z) [kA]	[deg]	Apparent Power [MVA]	X/R ratio	Asym.RMS X/R based [kA]	Asym.Peak X/R based [kA]	Sym.Base [kA]	Tot.Base [kA]
Bus8		230.00										
	Mom.Duty		0.950	40.761	2.866	-179.20	380.619	71.980	4.824	5.671		
	Zero-Seq		0.216	8.022						2 cycles	3.300	4.442
	Neg.-Seq		0.170	39.474						3 cycles	3.393	4.066
	Int.Duty		0.950	40.761	2.866	-179.20	380.619	71.980		5 cycles	3.449	3.746
	Zero-Seq		0.216	8.022						8 cycles	3.489	3.461
	Neg.-Seq		0.170	39.474								
	30-cycle		0.216	8.022	2.350	-179.11	312.034					
	Zero-Seq		0.216	8.022								
	Neg.-Seq		0.170	39.474								
Line78				Mom.Duty	1.255	-0.69	166.669		4.824	5.671		
				Int.Duty	1.255	-0.69	166.669			2 cycles	3.300	4.442
				30-cycle	1.029	-0.60	136.628			3 cycles	3.393	4.066
										5 cycles	3.449	3.746
										8 cycles	3.489	3.461
Line89				Mom.Duty	0.583	179.14	77.381		4.824	5.671		
				Int.Duty	0.583	179.14	77.381			2 cycles	3.300	4.442
				30-cycle	0.478	179.23	63.441			3 cycles	3.393	4.066
										5 cycles	3.449	3.746
										8 cycles	3.489	3.461
Line68				Mom.Duty	1.029	179.95	136.708		4.824	5.671		
				Int.Duty	1.029	179.95	136.708			2 cycles	3.300	4.442
				30-cycle	0.844	-179.96	112.079			3 cycles	3.393	4.066
										5 cycles	3.449	3.746
										8 cycles	3.489	3.461

COMPLETE

		DIgSILENT PowerFactory 15.1.7	Project:
			Date: 12/30/2022

Fault Locations with Feeders
Short-Circuit Calculation / Method : complete — 2-Phase to Ground / Max. Short-Circuit Currents

Short-Circuit Duration		Fault Impedance	
Break Time	0.10 s	Resistance, Rf	0.00 Ohm
Fault Clearing Time (Ith)	1.00 s	Reactance, Xf	0.00 Ohm

Grid: Grid — System Stage: Grid — Annex: / 1

		rtd.V. [kV]	Voltage [kV]	Voltage [deg]	c-Factor		Sk" [MVA/MVA]	Ik" [kA/kA]	Ik" [deg]	Ik' [kA]	ip [kA/kA]	Ib [kA]	ib [kA]	EFF [-]
Bus8	A	230.00	56.02	0.00	1.00		0.00 MVA	0.00 kA	0.0	0.00	0.00 kA	0.00	0.00	0.42
	B		0.00	-120.00			596.99 MVA	4.50 kA	129.1	3.28	12.72 kA	3.38	11.13	0.00
	C		0.00	120.00			596.99 MVA	4.50 kA	50.9	3.28	12.72 kA	3.38	11.13	0.00
Line78		Bus7				A	23.96 MVA	0.18 kA	-90.0	0.13	0.51 kA			
						B	293.72 MVA	2.21 kA	-54.6	1.61	6.26 kA			
						C	293.72 MVA	2.21 kA	-125.4	1.61	6.26 kA			
Line89		Bus9				A	12.09 MVA	0.09 kA	90.0	0.07	0.26 kA			
						B	105.43 MVA	0.79 kA	-45.6	0.58	2.25 kA			
						C	105.43 MVA	0.79 kA	-134.4	0.58	2.25 kA			
Line68		Bus6				A	11.87 MVA	0.09 kA	90.0	0.07	0.25 kA			
						B	199.13 MVA	1.50 kA	-48.2	1.09	4.24 kA			
						C	199.13 MVA	1.50 kA	-131.8	1.09	4.24 kA			