

به نام خدا

تمرین کامپیوتری سوم تحلیل سیستم های انرژی الکتریکی ۲

تحلیل خطای نامتقارن با استفاده از نرم افزار DigSilent



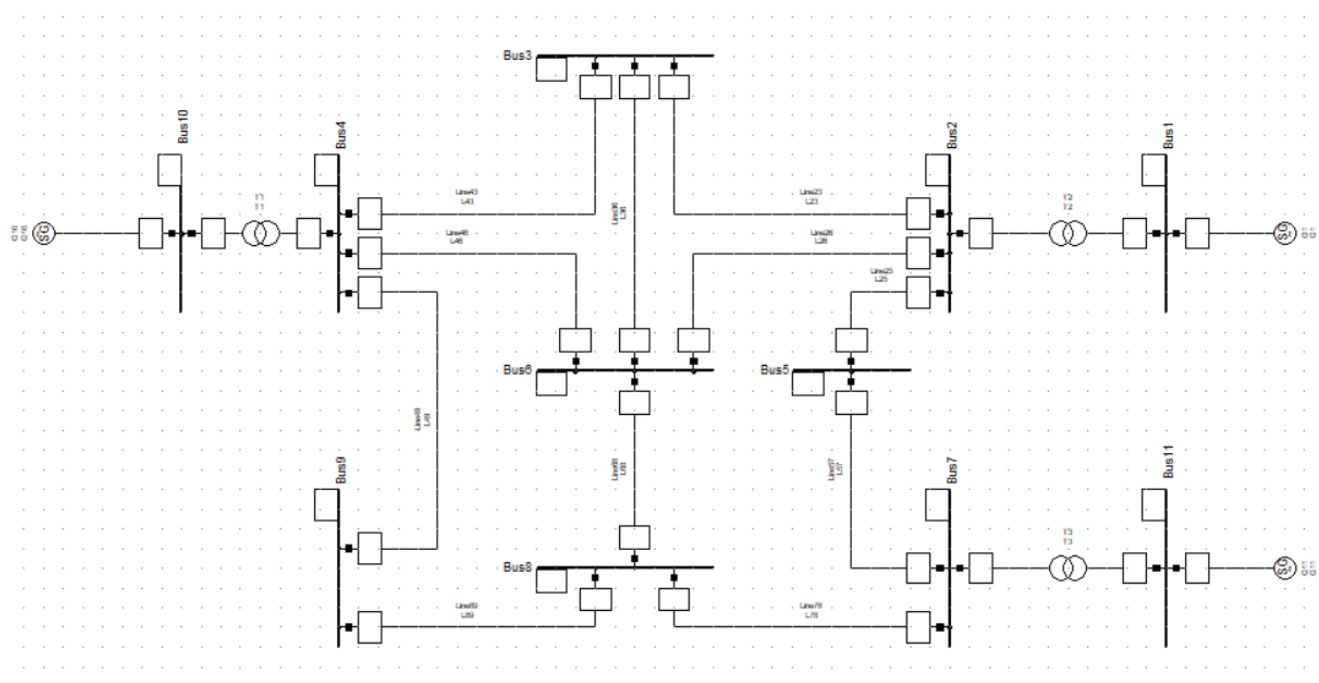
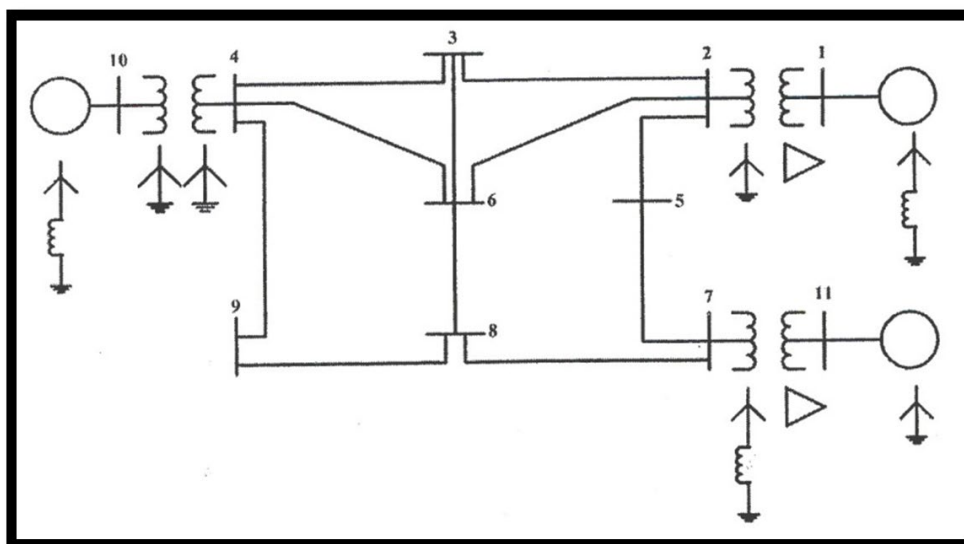
استاد درس: دکتر مسعود علی اکبر گلکار

دانشجو: رضا آقاجری

شماره دانشجویی: ۹۸۱۹۵۸۳

زمستان ۱۴۰۱

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



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

## ترانسفورماتور ها:

Object Filter: \*.TypTr2

	Name	In Folder	Grid	Technology	rd Pow. MVA	Nominal Frequency Hz	HV-Hd Volt. kV	LV-Hd Volt. kV	Shc Volt. %	Cop. Los. kW	Re(Shc Volt. %)	Ratio X/R	x1 p.u.	r1 p.u.	HV/Vec Grp	LV/Vec Grp	Internal Delta Win...	Ph. Shift °30deg	Nam
▶	T1	Equipment Type Libr		Transformer	100	50	230	20	3	0	0	9999999	0.03	0	YN	YN		0	YN
▶	T2	Equipment Type Libr		Transformer	100	50	230	20	3	0	0	9999999	0.03	0	YN	D		0	YN
▶	T3	Equipment Type Libr		Transformer	100	50	230	20	3	0	0	9999999	0.03	0	YN	D		0	YN

Ln 1 3 object(s) of 3 1 object(s) selected [Drag & Drop]

7°C Haze 6:30 PM 12/30/2022

## شین ها:

Object Filter: \*.TypBar

	Name	In Folder	Grid	Nom. Volt. kV
▶	B1	Equipment Type Libr		20
▶	B10	Equipment Type Libr		20
▶	B11	Equipment Type Libr		20
▶	B2	Equipment Type Libr		230
▶	B3	Equipment Type Libr		230
▶	B4	Equipment Type Libr		230
▶	B5	Equipment Type Libr		230
▶	B6	Equipment Type Libr		230
▶	B7	Equipment Type Libr		230
▶	B8	Equipment Type Libr		230
▶	B9	Equipment Type Libr		230

Ln 1 11 object(s) of 11 1 object(s) selected [Drag & Drop]

7°C Haze 6:32 PM 12/30/2022

## خطوط انتقال:

Object Filter: \*.TypLine

Name	In Folder	Grd	Rtd. Voltage kV	rat. Current kA	rat. Current (ar) kA	Nominal Frequency Hz	Cable / OHL	Sys. Tp.	Phases	Number of Neutrals	R(AC,20°C) Ohm/km	X' Ohm/km	L' mH/km	R0(AC) Ohm/km	X0 Ohm/km	L0' mH/km	Rn(AC) Ohm/km	Xn' Ohm/km
L23	Equipment Type Libr		230	1	1	50	0	AC	3	0	0	0.15	0.47740	0	0.3	0.95495	0	0
L25	Equipment Type Libr		230	1	1	50	0	AC	3	0	0	0.45	1.43239	0	0.9	2.86478	0	0
L26	Equipment Type Libr		230	1	1	50	0	AC	3	0	0	0.4	1.27324	0	0.8	2.54647	0	0
L36	Equipment Type Libr		230	1	1	50	0	AC	3	0	0	0.4	1.27324	0	0.8	2.54647	0	0
L43	Equipment Type Libr		230	1	1	50	0	AC	3	0	0	0.6	1.90985	0	1	3.18309	0	0
L46	Equipment Type Libr		230	1	1	50	0	AC	3	0	0	0.7	2.22816	0	1.1	3.50140	0	0
L49	Equipment Type Libr		230	1	1	50	0	AC	3	0	0	0.43	1.36873	0	0.8	2.54647	0	0
L57	Equipment Type Libr		230	1	1	50	0	AC	3	0	0	0.48	1.52788	0	0.95	3.02394	0	0
L68	Equipment Type Libr		230	1	1	50	0	AC	3	0	0	0.35	1.11408	0	0.7	2.22816	0	0
L78	Equipment Type Libr		230	1	1	50	0	AC	3	0	0	0.48	1.52788	0	0.9	2.86478	0	0
L89	Equipment Type Libr		230	1	1	50	0	AC	3	0	0	0.48	1.52788	0	0.9	2.86478	0	0

Ln 1 11 object(s) of 11 1 object(s) selected Drag & Drop

7°C Haze 6:33 PM 12/30/2022

## ژنراتور ها:

Object Filter: \*.TypSym

Name	In Folder	Grd	App. Pow. MVA	Nom. Volt. kV	Pow. Fact.	Connection
G1	Equipment Type Libr		100	20	1	YN
G10	Equipment Type Libr		100	20	1	YN
G11	Equipment Type Libr		100	20	1	YN

Ln 1 3 object(s) of 3 1 object(s) selected Drag & Drop

7°C Haze 6:33 PM 12/30/2022

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]	c- [deg]	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					
				Conductor Temperature User Defined				No		Break Time Fault Clearing Time (Ith) c-Voltage Factor User Defined		0.10 s 1.00 s No	
Grid: Grid				System Stage: Grid				Annex:				/ 1	
		rtd.V. [kV]	Voltage [kV]	c- Factor	deg	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					8.60 MVA	0.06 kA	91.27	0.17 kA				
						166.69 MVA	1.26 kA	-0.22	3.34 kA				
						166.69 MVA	1.26 kA	-177.26	3.34 kA				
Line89	Bus9					4.52 MVA	0.03 kA	-88.73	0.09 kA				
						77.40 MVA	0.58 kA	2.93	1.55 kA				
						77.40 MVA	0.58 kA	179.59	1.55 kA				
Line68	Bus6					4.08 MVA	0.03 kA	-88.73	0.08 kA				
						136.74 MVA	1.03 kA	2.11	2.74 kA				
						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				Short-Circuit Duration				0.10 s			
								Break Time				1.00 s			
				Conductor Temperature User Defined				c-Voltage Factor User Defined				No			
				No											
Grid: Grid				System Stage: Grid				Annex:				/ 1			
		rtd.V. [kV]	Voltage [kV]	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												
Asynchronous Motors Always Considered		Grid Identification Automatic  Conductor Temperature User Defined		Short-Circuit Duration Break Time Fault Clearing Time (Ith) c-Voltage Factor User Defined								
		No		0.10 s 1.00 s No								
Grid: Grid		System Stage: Grid			Annex: / 1							
		rtd.V. [kV]	Voltage [kV]	c- [deg]	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					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					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					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							
Pre-fault Voltage Consider Transformer Taps				1.00 p.u. No		Fault Impedance Resistance, Rf Reactance, Xf	
				0.00 Ohm 0.00 Ohm		NACD Mode Currents/Voltages for	
						Interpolated 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]	
Mom.Duty		0.950 40.761		4.513 -89.13		8.925 5.386	
Zero-Seq		0.216 8.022				2 cycles 5.386	
Neg.-Seq		0.170 39.474				3 cycles 5.692	
Int.Duty		0.950 40.761		4.513 -89.13		5 cycles 5.826	
Zero-Seq		0.216 8.022				8 cycles 6.016	
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	
Int.Duty		2.134 90.88		283.310		2 cycles 5.386	
30-cycle		1.778 90.95		236.118		3 cycles 5.692	
						5 cycles 5.826	
						8 cycles 6.016	
Line89		Mom.Duty		0.836 90.84		111.069 7.587	
Int.Duty		0.836 90.84		111.069		2 cycles 5.386	
30-cycle		0.697 90.91		92.575		3 cycles 5.692	
						5 cycles 5.826	
						8 cycles 6.016	
Line68		Mom.Duty		1.543 90.86		204.937 7.587	
Int.Duty		1.543 90.86		204.937		2 cycles 5.386	
30-cycle		1.286 90.93		170.812		3 cycles 5.692	
						5 cycles 5.826	
						8 cycles 6.016	

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				Resistance, Rf				0.00 Ohm							
Fault Clearing Time (Ith)				Reactance, Xf				0.00 Ohm							
0.10 s															
1.00 s															
Grid: Grid				System Stage: Grid				Annex: / 1							
		rtd.V. [kV]	Voltage [kV]	c- [deg]	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					283.31 MVA	2.13 kA	90.0	1.78	6.03 kA					
						22.05 MVA	0.17 kA	72.1	0.14	0.47 kA					
						22.05 MVA	0.17 kA	107.9	0.14	0.47 kA					
Line89	Bus9					111.07 MVA	0.84 kA	90.0	0.70	2.37 kA					
						11.28 MVA	0.08 kA	-108.4	0.07	0.24 kA					
						11.28 MVA	0.08 kA	-71.6	0.07	0.24 kA					
Line68	Bus6					204.94 MVA	1.54 kA	90.0	1.29	4.37 kA					
						10.77 MVA	0.08 kA	-107.3	0.07	0.23 kA					
						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				Short-Circuit Duration				0.10 s							
				Conductor Temperature User Defined				Break Time				1.00 s							
				No				Fault Clearing Time (Ith)											
								c-Voltage Factor				No							
								User Defined				No							
Grid: Grid												System Stage: Grid				Annex: / 1			
		rtd.V. [kV]	Voltage [kV]	c- [deg]	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 Consider Transformer Taps		1.00 p.u. No		Fault Impedance Resistance, Rf Reactance, Xf		0.00 Ohm 0.00 Ohm		NACD Mode Currents/Voltages for		Interpolated 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	Tot.Base
Mom.Duty		0.950 40.761		2.866 -179.20		380.619	71.980	4.824	5.671	[kA]	[kA]
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]	c- [deg]	Factor	Sk" [MVA/MVA]	Ik" [kA/kA]	Ik' [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				Short-Circuit Duration				0.10 s			
				Conductor Temperature User Defined No				Break Time				1.00 s			
								Fault Clearing Time (Ith)							
								c-Voltage Factor				No			
								User Defined				No			
Grid: Grid				System Stage: Grid								Annex: / 1			
		rtd.V. [kV]	Voltage [kV]	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 Consider Transformer Taps		1.00 p.u. No		Fault Impedance Resistance, Rf Reactance, Xf		0.00 Ohm 0.00 Ohm		NACD Mode Currents/Voltages for Interpolated 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										
	Mom.Duty	0.950	40.761	2.866	-179.20	380.619	71.980	4.824	5.671	Sym.Base [kA]	Tot.Base [kA]
	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]	c- [deg]	Factor	Sk" [MVA/MVA]	Ik" [kA/kA]	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			