

**The 19th International Conference on  
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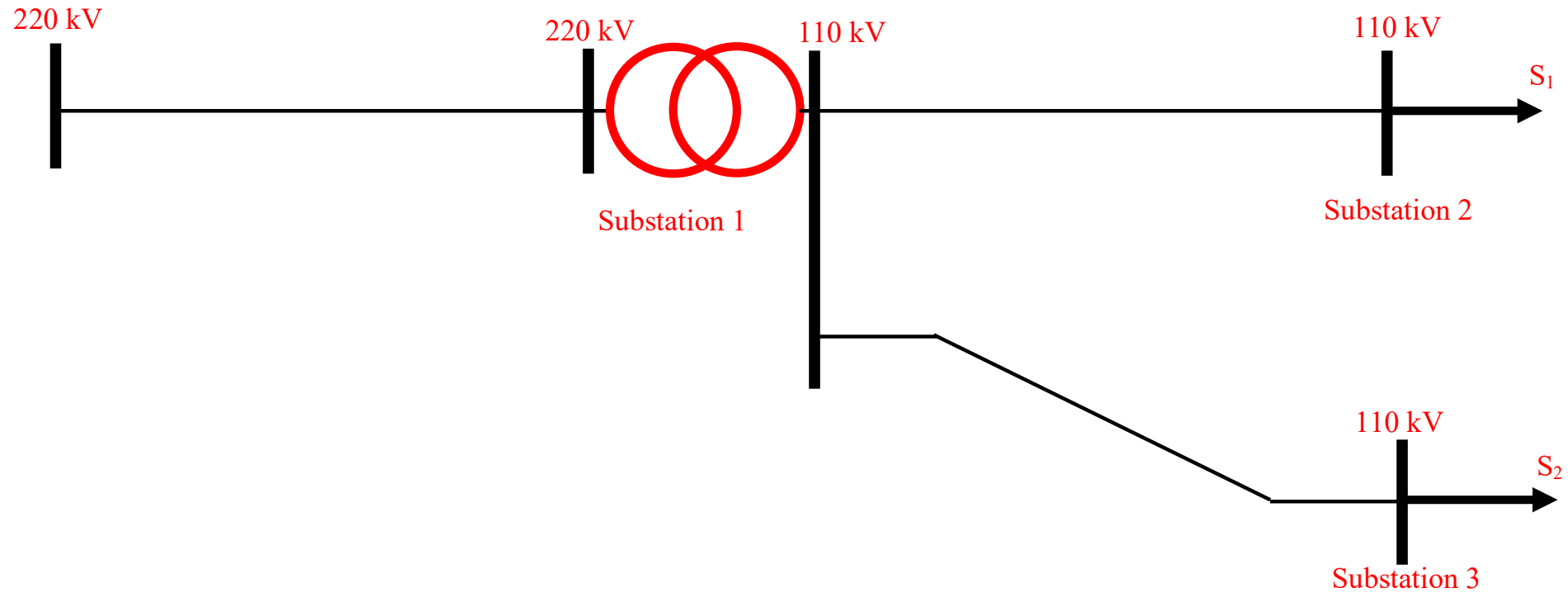


**OVERVOLTAGE WHEN SHUTTING OFF A SHORT  
CIRCUIT IN NETWORKS EQUIPPED WITH AUTOMATIC RE-TURNING ON**

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Electrical diagram of the considered network

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Overvoltage in the considered network in its normal mode,  
when disconnecting the short circuit and turning on the load 1 using automatic reclosure

TABLE 1.

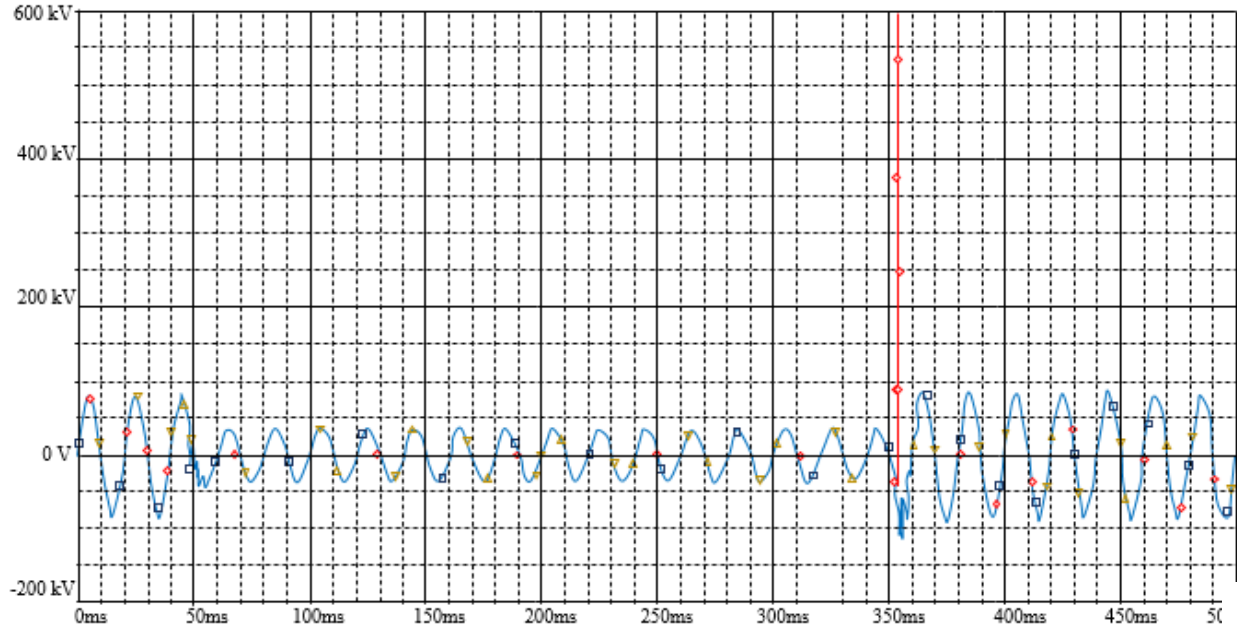
Network mode	$i_{s.c}$	Shutdown time switches	$I_{disc}$	$U_{w2start}$	$U_{w2end}$	$U_{nl}$	$U_2$
	kA	ms	A	kV	kV	kV	kV
Normal	-	-	-	83,759	81,55	81,55	81,92
Start of short circuit	1,645	$t_w=45.169$	-	37,357	0	0	36,02
Load 1 disabled		$t_{2\text{ disable}}=353.197$	0	111,427	115,511	0	110,35
Load 1 disabled		$t_{2\text{ turn off}}=353.19$	3,47	109,99	241,276	0	108,99
Load 1 disabled		$t_{2\text{ turn off}}=353.182$	6,94	111,398	595,684	0	110,32
Load 1 disabled		$t_{2\text{ turn off}}=353.175$	8,72	109,907	905,813	0	108,73
Load 1 disabled		$t_{2\text{ turn off}}=353.153$	14,82	111,593	1305	0	110,50
Load 1 disabled		$t_{2\text{ load}}=353.153$	20,83	111,684	1880	0	110,33
Disappearance of a short circuit	-	$t_{disc}=500$	-	85,409	85,879	0	83,895
Load 1 on	-	$t_{2\text{ turn on}}=677$	-	83,683	81,250	81,35	81,944

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Overvoltage in the network under consideration when a short-circuit is switched off with a two-contact

Resistance reactivation resistor	$I_{short}$	Open time of breaker		$U_{wstart}$	$U_{wrest}$	$U_{in1}$	$U_{in2}$
		Main contact	Auxiliary contact				
	A	ms	ms	kV	kV	kV	kV
0	0	53,183	-	37,353	0	0	36,68
		353,183	383,246	111,61	2148	0	110,06
100		353,193	-	71,86	59,129	0	70,18
		353,193	391,343	87,94	1124	0	85,93
400		353,211	-	82,40	78,24	0	80,40
		353,211	390,625	88,10	720,3	0	86,03
450		353,201	-	84,42	81,41	0	83,41
		353,201	390,535	88,35	133,14	0	86,33
500		353,193	-	86,46	82,64	0	85,41
		353,193	390,509	87,640	87,950	0	85,54
550		353,193	-	85,940	84,93	0	85,05
		353,193	390,520	86,256	88,400	0	86,16
600		353,193	-	86,57	86,27	0	84,60
		353,193	90,510	89,67	221,79	0	88,27

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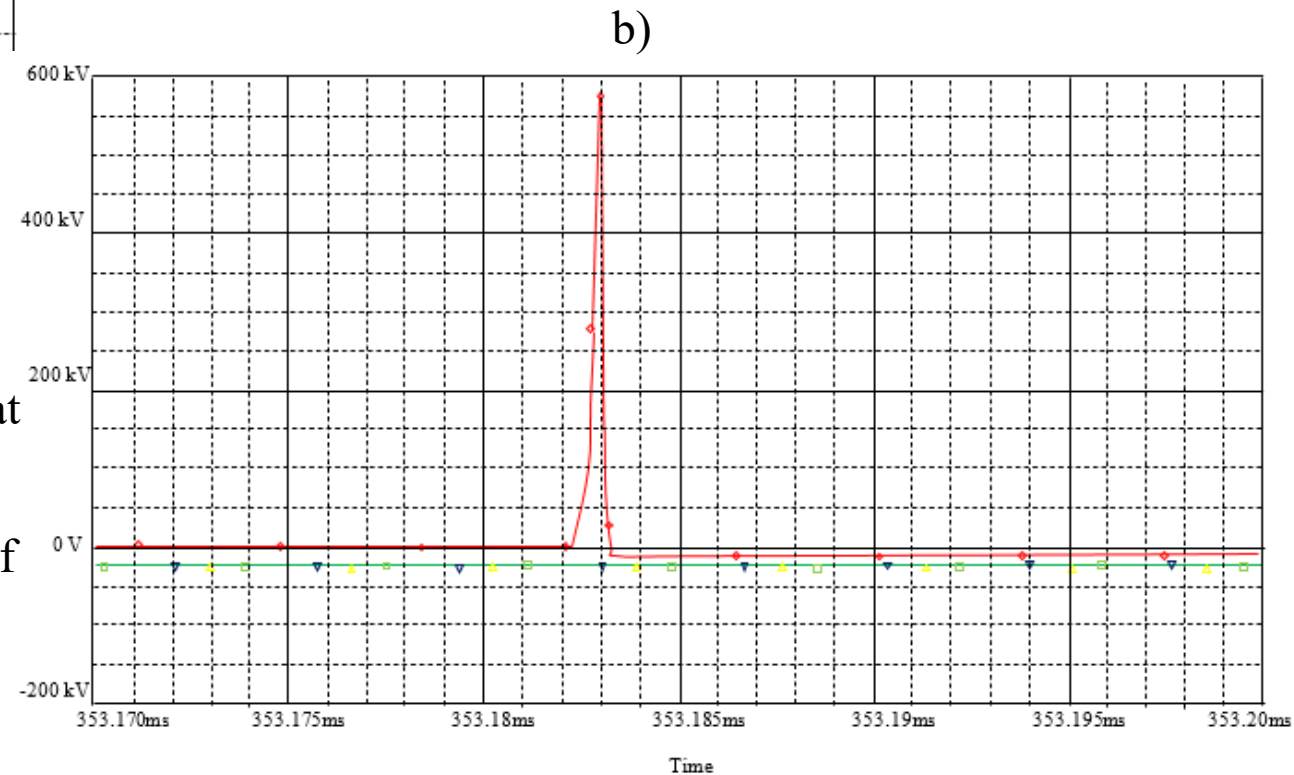


a)

Surge at the end and at the beginning of line 2, and at the end of line 3 at a cutoff current of 6.94 A.

a - surge at the end of line 2 (red), at the beginning of line 2 (blue) and at the end of line 3 (green);

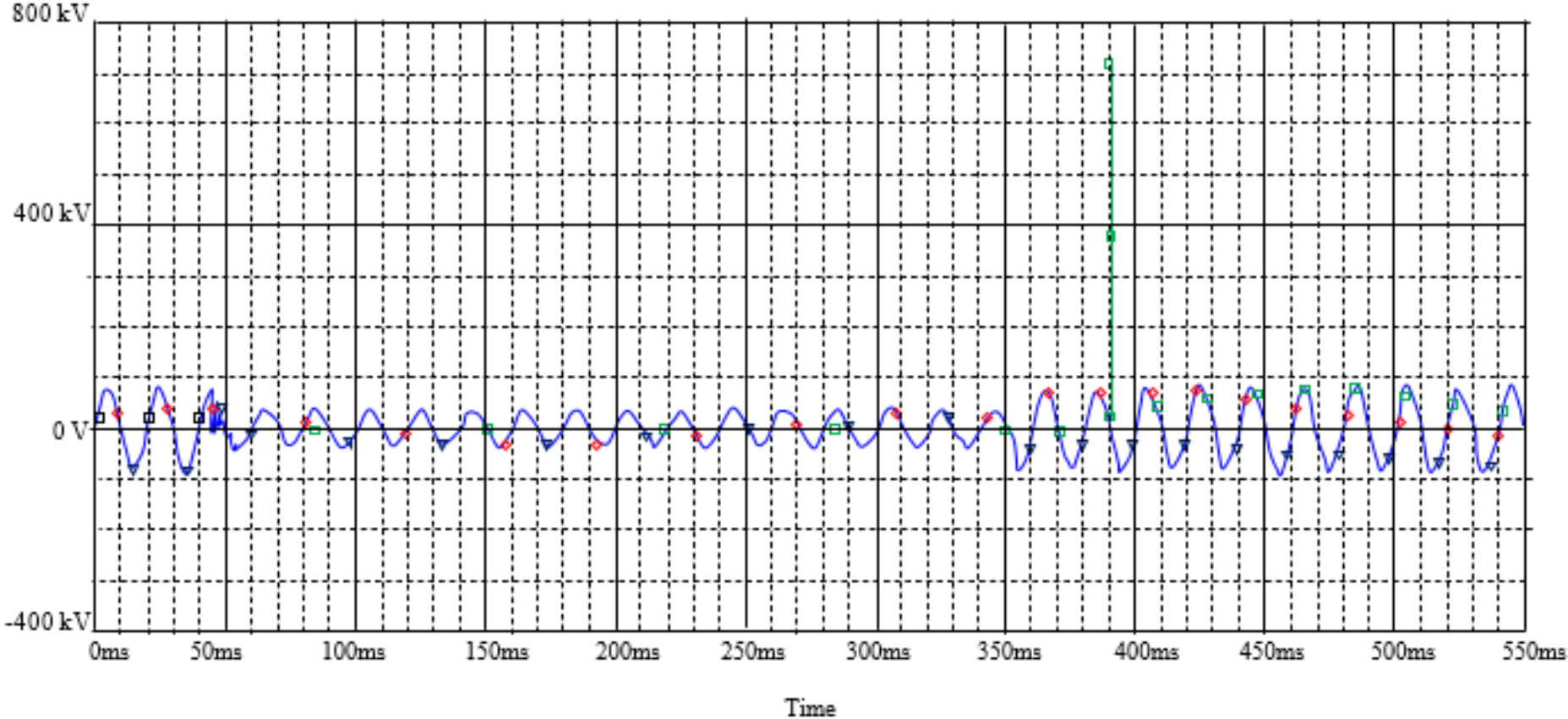
b - surge at the end of line 2



b)

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Overvoltage at the end and at the beginning of line 2, and at the end of line 3 when using a two-contact switch with the resistance of the upstream resistor is 400 Ω. green - at the end of line 2, red - at the beginning of line 2, blue - at the end of line 3



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1. When the short circuit is turned off, the value of the cutoff current strongly affects the resulting overvoltages, in which the voltage in the network becomes equal to the linear value. Duration especially at the point of current breakdown.

The overvoltage at this point increases abruptly, having the form of a surge and quickly decays. Then it occurs after an emergency steady state, in which the voltage in the network increases to a linear value. The duration of the burst is very short, 1-1.5  $\mu$ s.

2. The use of two contact switches with an upstream resistor with a resistance equal to the characteristic impedance of the power line limits this overvoltage to their linear values.

3. Changing the value of this resistance from the value of the wave resistance of the power line in one direction or the other increases the overvoltage when the short circuit is turned off.

4. The use of surge arresters limit switching overvoltage to two times the phase voltage.

## CONCLUSIONS