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Digital twin for smart electricity distribution networks

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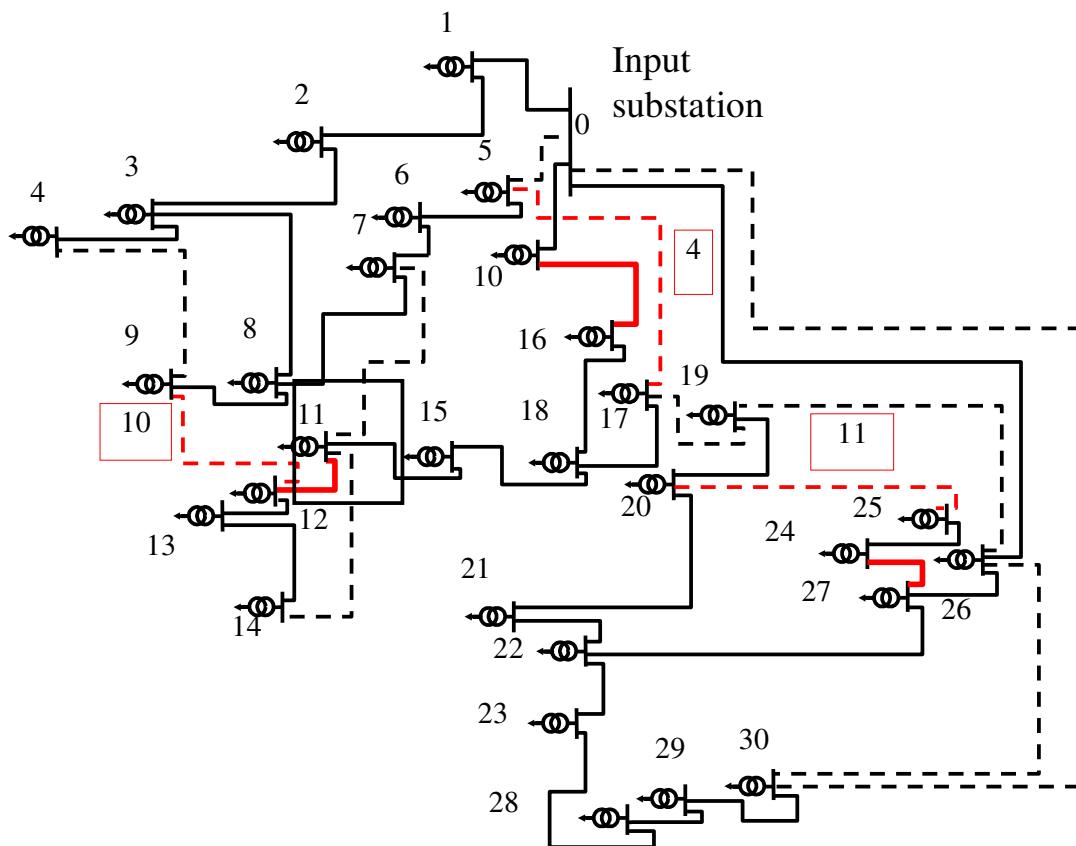




Power network diagram

«Альтернативная
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энергетика»

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Critical events list (fragment).

	The numbers of critical events						
	1	2	...	10	11	...	30
Substations numbers	0-1	1-2	...	0-26	26-27	...	24-25



Critical events and decision rules

Critical events matrix.

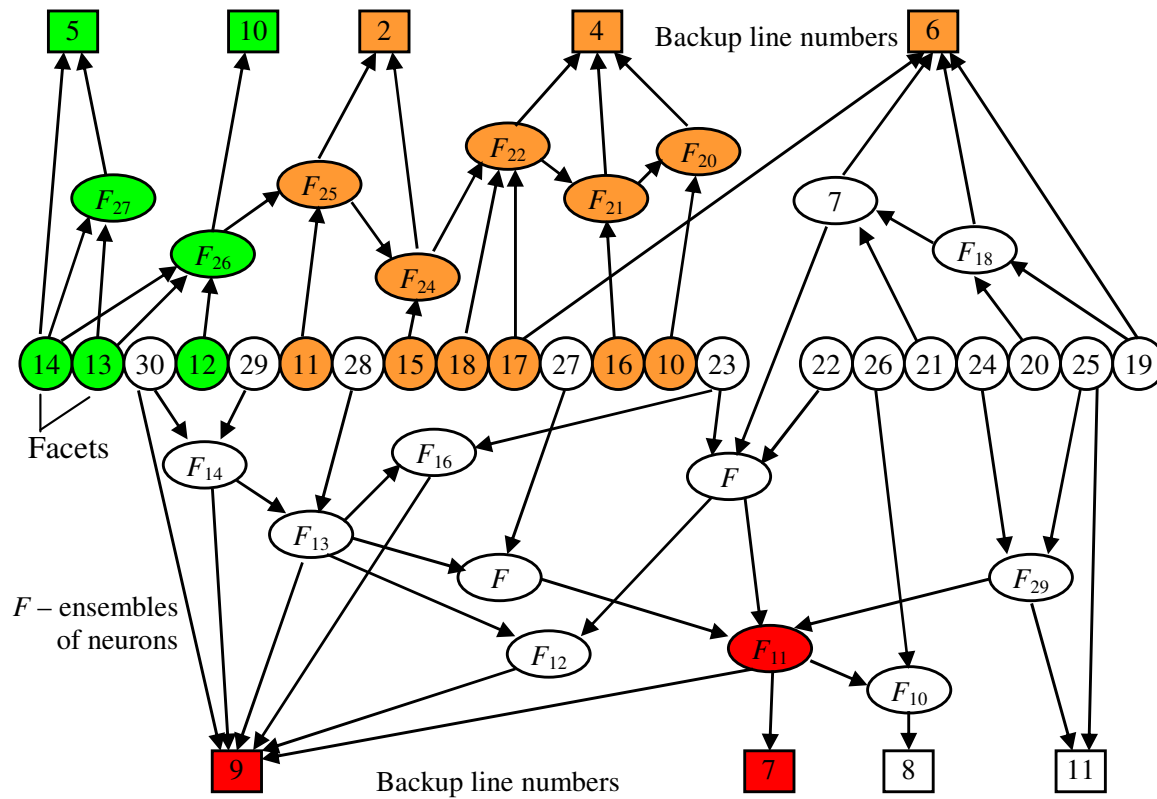
Event number	De-energized substation numbers																														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	...	30		
1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	...	0		
2	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	...	0		
3	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	...	0		
4	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	...	0		
5	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	...	0		
...	
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	...	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	...	0

Decision rules matrix.

Event number	Substation numbers with pluggable backup lines (backup line numbers)										
	4-9 (1)	7-11 (2)	0-5 (3)	5-17 (4)	11-14 (5)	17-19 (6)	19-26 (7)	0-30 (8)	30-26 (9)	9-12 (10)	20-25 (11)
1	0	0	1	0	0	0	0	0	0	0	0
2	0	0	1	0	0	0	0	0	0	0	0
3	0	0	1	0	0	0	0	0	0	0	0
4	1	0	0	0	0	0	0	0	0	0	0
...
30	0	0	0	0	0	0	0	0	0	0	1



Distribution network faceted model

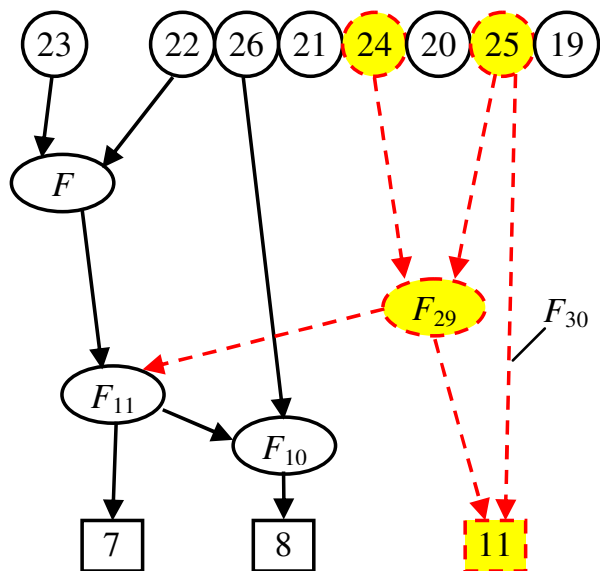




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Rebuilding the network

Digital twin for smart electricity distribution networks



Rebuilding the network when the new events 29 and 30 are trained (disconnection of substations 24, 25).

When new events 29 and 30 appear (switching off the substations 24, 25) the neural network structure is implemented without changing the previously formed structural connections



References

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4. Podvalny S L and Vasiljev E M 2020 The cybernetic concept of multialternativity in the evolution of biological systems *J. of Physics: Conf. Series, Applied Mathematics, Computational Science and Mechanics: Current Problems* vol 1479 012109 (Voronezh, Russian Federation: IOP Publishing)
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