UPON A METHOD FOR PROCESSING STATISTICS FROM EXPLOITATION OF COMMUNICATION CABLES

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The paper deals with results from exploitation measurements of communication cables at Veliko Turnovo district long distance communications hub for the period 1997-2002. Data has been collected as passive experiment from the records of exploitation measurements. An empirical dependency of the capacity of the respective cable of the resistance of insulation and resistance of the train. The methodology can be used to evaluate the performance of different technical objects.

Exploitation measurements occupy main place in the exploitation of technical equipment and systems. They show the technical condition of the systems and their ability to perform their functions. The results from exploitation measurements allow evaluating the condition of the systems and forecasting their performance.

It is known that communication cables are complex as a system for diagnosis and prognoses. Characteristic of measurements made with them is that with all parameters under examination there is significant tolerability, which depends on external conditions. This paper offers a method for such statistics.

It is also known that the capacity of communication cables impacts significantly their secondary parameters. On the other hand, it depends largely on the controlled parameters of cables: insulation resistance against earth, resistance of insulation between conductors and resistance of the train.

The paper deals with measurements of communication cables in Veliko Turnovo district long distance communications hub for the period 1997-2002. The excerpt covers interurban cables of the types МККБ 4x4+15x4x1,2; ТЗБ 7x4x1,2; ТЗБ 7x4x0,9; ТЗБ 12x4x1,2 etc.

The task is specific because the data is collected during passive experiment – the logs of experiment measurements.

The aim of the modeling is to define the empirical dependence of the capacity of the respective type of cable on the resistance of insulation and resistance of train. The primary processing of data showed that it is advisable to select a model of the type:

$$C = b_0 + b_1R_a + b_2R_b + b_3R_s + b_4R_a^2 + b_5R_b^2 + b_6R_s^2 + b_7R_aR_b + b_8R_aR_s + b_9R_bR_s, \quad (1)$$

where b_i (i=0..9) are the coefficients needed for the regressive model;

R_a – resistance of insulation against earth of the first conductor;

R_b – resistance of insulation against earth of the second conductor

R_s – resistance of train between the two conductors.

The digital processing of data has been made in Integrated development environment (IDE) MATLAB.

Figures 1,2,3,4 and 5 show the dependences of the capacity on the measured definitions as 'dashed line' is the experimental dependence, while the solid line - the model.

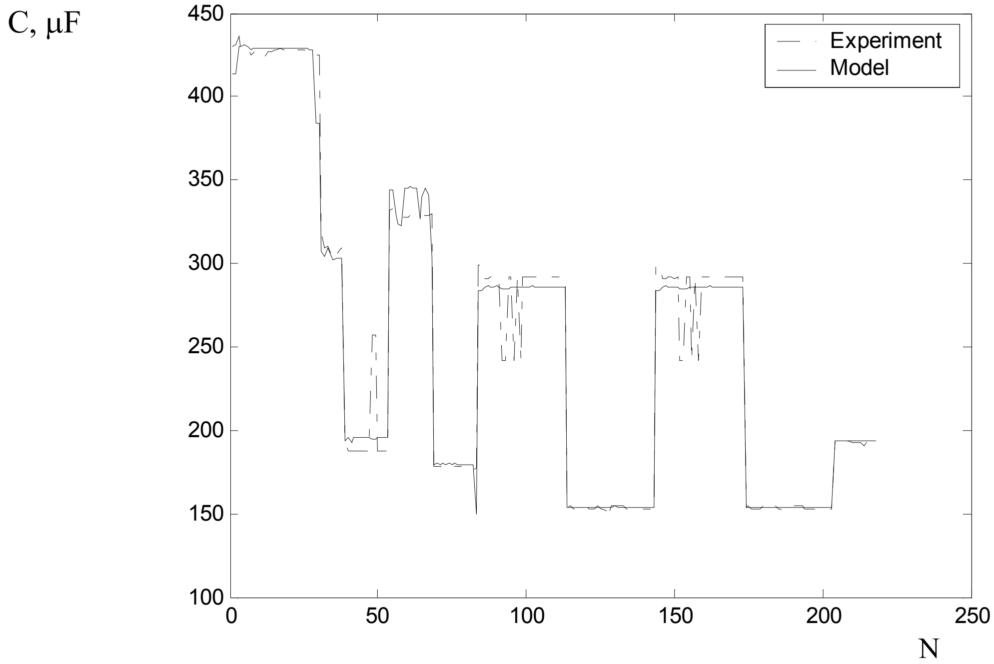

Fig. 1. Graphics displaying the correspondence of the experimental data and the model of capacity of cable of the type МККБ 4x4+15x4x1,2 at low frequency signals

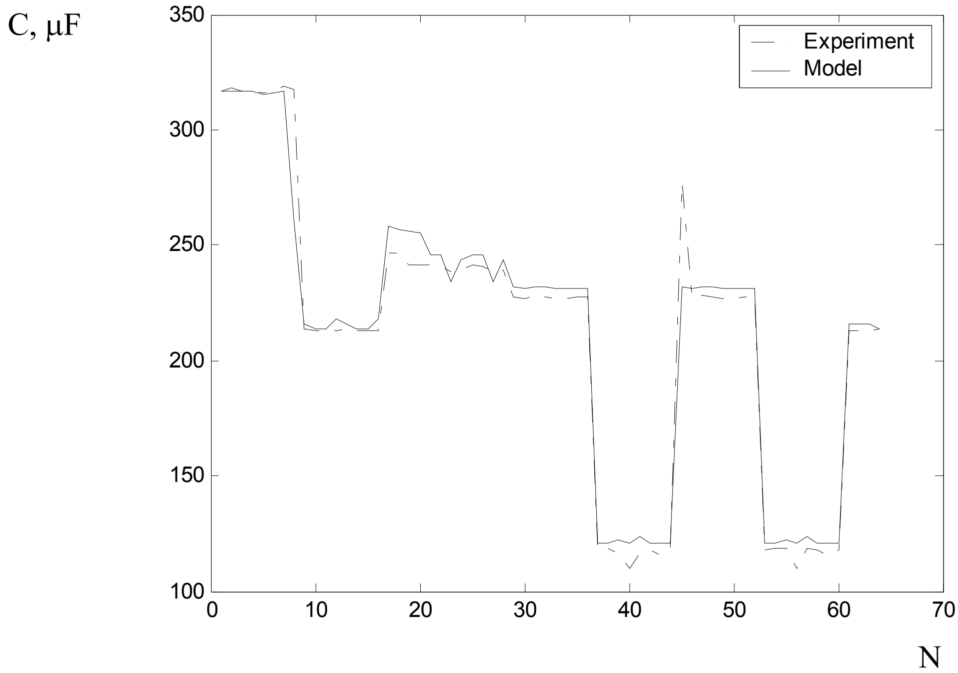

Fig. 2. Graphics displaying the correspondence of the experimental data and the model of capacity of cable of the type МККБ 4x4+15x4x1,2 at high frequency signals

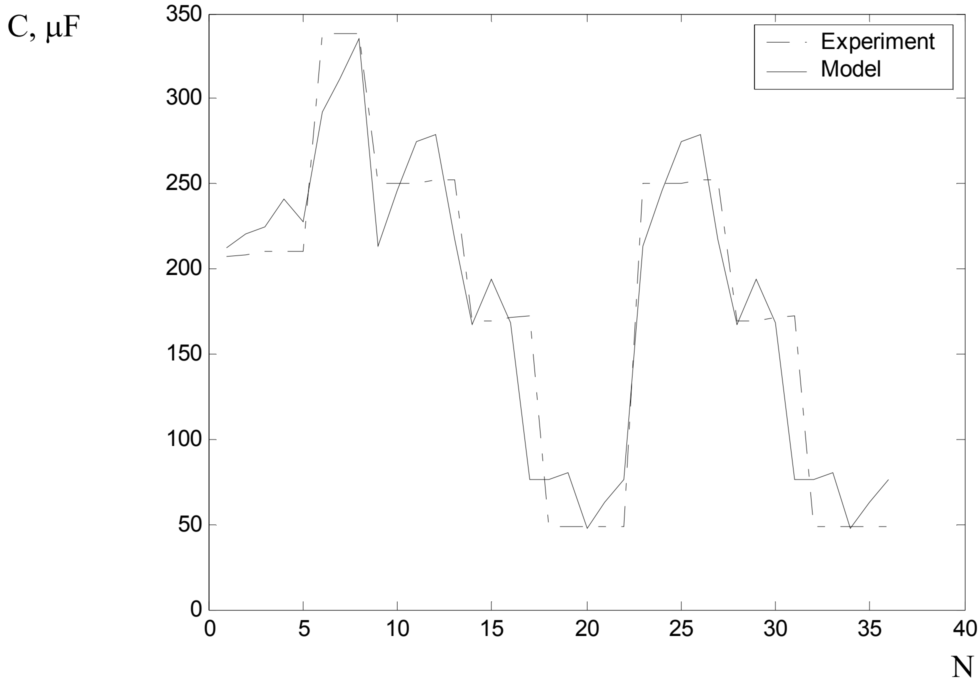

Fig. 3. Graphics displaying the correspondence of the experimental data and the model of capacity of cable of the type ТЗБ 7x4x0,9

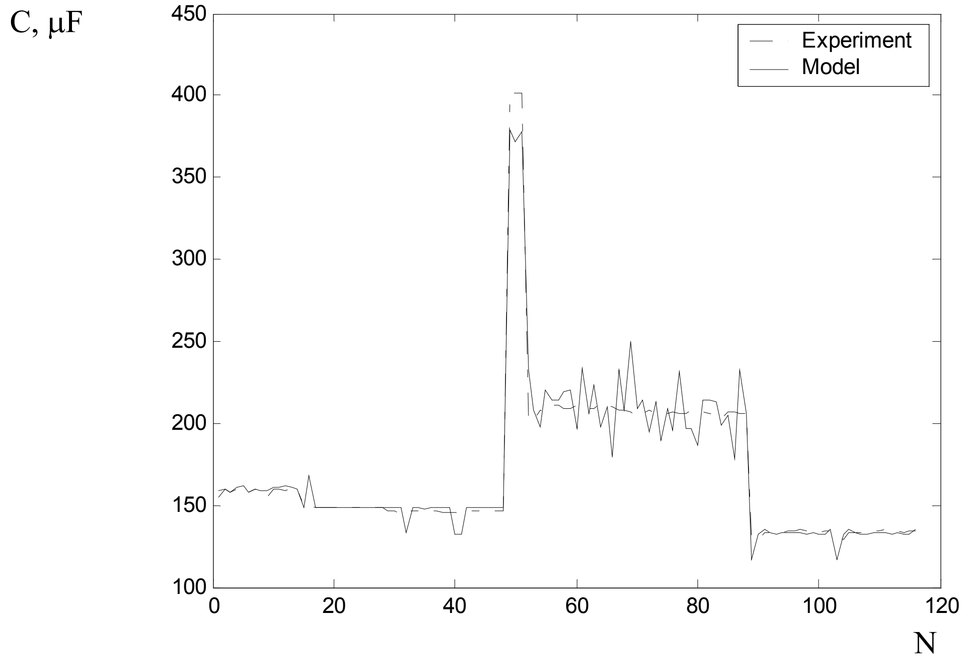

Fig. 4. Graphics displaying the correspondence of the experimental data and the model of capacity of cable of the type ТЗБ 7x4x1,2

The graphics display good correspondence between model and experiment. The adequacy of the models proposed is evaluated by means of Fischer's criterion, the values of which for the different types of cables are shown in table 1.

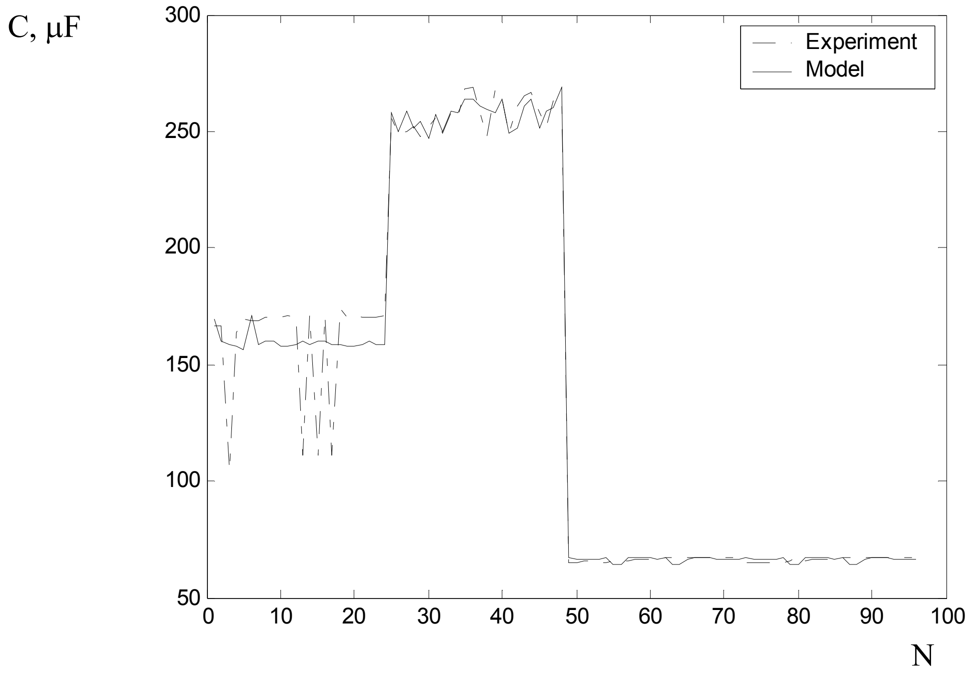

Fig. 5. Graphics displaying the correspondence of the experimental data and the model of capacity of cable of the type ТЗБ 12x4x0,9

The high values of this criterion show that the models describe well enough the dependences evaluated by means of exploitation measurements.

Table 1

N:	Type of cable	Fischer's Criterion	
		model	Critical value
1.	МККБ 4x4+15x4x1,2 (НЧ)	1248.9	1.3829
2.	МККБ 4x4+15x4x1,2 (ВЧ)	199.66	1.9068
3.	ТЗБ 7x4x0,9	20.475	2.5891
4.	ТЗБ 7x4x1,2	231.38	1.5781
5.	ТЗБ 12x4x0,9	436.75	1.6614

The methodology offered allows making and forecasting the performance of the cables under examination.

In some of the graphics there are deviations of the model of the experiment. It is due to different external circumstances: temperature and humidity of air, different time and season of the year etc. The methodology proposed allows reflecting these peculiarities when respective data is available and in this way there is rendered the thin structural dependence of the characteristics examined on the parameters of the cable.

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