

SEARCH DAMAGE IN THE ELECTRICAL SUPPLY NETWORK ON THE BASIS OF NON-LITHUANIAN LOGIC

In the computerized diagnosis of power supply damage, the heuristic knowledge of dispatchers can be combined with the information received from the network database and SCADA system. However, the nature of heuristic knowledge is inaccurate and uncertain. Also, information received from the remote control system contains uncertainty and may be incorrect or controversial. In this connection, in this paper, a method based on the theory of fuzzy sets is proposed for working with the uncertainty of the localization of damage in the power supply lines (ETL).

The task is developing some expert system which would be realized as a system of fuzzy output and would allow determining the place of malfunction in the power supply network on the basis of data received from hydro meteorological and informal knowledge of dispatchers.

Empirical knowledge of this problem area can be presented, for example, in the form of the following heuristic rules for a separate section of the transmission line:

1. If the wind is strong and the icing is low, then a malfunction occurred on this site;

2. If the precipitation level is high and the temperature is low, then the malfunction occurred on this site;

3. If there were no weather conditions that caused a malfunction, but nearby is a populated area, then a malfunction occurred on this site, etc.

That is, the a priori distribution power line 10 kV is divided into several sections. Such power lines may deviate from the substation a few.

As input meteorological parameters of the system of fuzzy output factors that influence the possible damage to the transmission line, expressed in fuzzy linguistic variables: "wind speed", "precipitation", "icing", "temperature", and as output parameters is fuzzy linguistic variable "occurrence of a malfunction". As terms of the set of linguistic variables, the term "low", "medium", "high" is used for both input and output parameters, since the possibility of a malfunction may be just as "low", "medium", "high". When the results of the research "failure" is "low" or "average", then we can neglect this and only when we get the result "high", so the most likely in this section of the power line and a malfunction occurred.

To the current meteorological data in the system of fuzzy logical conclusion also added fuzzy concepts: proximity to the forest area, which can be a factor in the damage, proximity to the reservoir, which may affect the physical properties of supports and metals, proximity to settlements and proximity to roads, which increases the likelihood of the human factor. False estimates of these factors are determined expertly for each section of each line.

For each of the meteorological input variables we create the functions of membership and determine their terms. Consider these calculations on an example of wind.

The degree of belonging of the parameter "wind" to the term "low", "medium" and "high" is calculated as follows:

$$\mu_{\text{low}}(x) = \begin{cases} 1 & \text{if } x \leq 1 \\ \frac{3-x}{2} & \text{if } 1 < x < 3 \\ 0 & \text{if } x \geq 3 \end{cases} \quad (1)$$

$$\mu_{\text{medium}}(x) = \begin{cases} 0 & \text{if } x \leq 1 \\ \frac{x-1}{2} & \text{if } 1 < x < 3 \\ \frac{3-x}{2} & \text{if } 3 < x < 5 \\ 0 & \text{if } x \geq 5 \end{cases} \quad (2)$$

$$\mu_{\text{high}}(x) = \begin{cases} 0 & \text{if } x \leq 3 \\ \frac{x-3}{2} & \text{if } 3 < x < 5 \\ 1 & \text{if } x \geq 5 \end{cases} \quad (3)$$

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The implementation of the fuzzy logical output of Mamdani has the form:

$$L_{i,j} = A3_i \wedge \left(\begin{array}{l} \text{Об}_{ni,j} \wedge V_{ei,j} \vee \text{Об}_{ci,j} \wedge (V_{ci,j} \vee V_{ei,j}) \vee \text{Об}_{ei,j} \wedge \\ (V_{ci,j} \vee V_{ei,j} \vee V_{ni,j}) \vee O_{ei,j} \vee T_{ni,j} \vee T_{ei,j} \vee \\ \text{Л}_{i,j} \vee P_{i,j} \vee H_{i,j} \vee \text{Д}_{i,j} \end{array} \right)$$

$$\mu_{L_{i,j}} = \min \left(\mu_{A3_i}, \left(\begin{array}{l} \max(\min(\mu_{\text{Об}_{ni,j}}, \mu_{V_{ei,j}}), \min(\mu_{\text{Об}_{ci,j}}, \\ \max(\mu_{V_{cc,j}}, \mu_{V_{ee,j}})); \min(\mu_{\text{Об}_{ei,j}}, \\ \max(\mu_{V_{nn,j}}, \mu_{V_{ee,j}}, \mu_{V_{cc,j}})); \\ \max(\mu_{O_{ei,j}}, \mu_{T_{ni,j}}, \mu_{T_{ei,j}}, \mu_{\text{Л}_{i,j}}, \mu_{P_{i,j}}, \\ \mu_{H_{i,j}}, \mu_{\text{Д}_{i,j}} \end{array} \right) \right) \quad (4)$$

$$i = 1, \dots, m; \quad j = 1, \dots, n.$$

where $L_{i,j}$ – linguistic variable "damage to j area of i TEP", $\square L_{i,j}$ – is the degree of belonging of the linguistic variable "damage to j -th area of and-nd TEP", m – number of transmission lines, n – number of allocated areas on each transmission line, $A3_i$ – the level of precipitation, Об – level of icing, O – rainfall level, T – temperature of air, Λ – proximity to forest area, P – proximity to the reservoir, H – proximity to settlements, Δ – proximity to roads, \square – accessory functions, indices n, c, v – terms low, medium, high.

For practical applications, this model is implemented in the MatLab package.

If a signal has been received about the breakdown of the transmission line, with what the protective equipment most often operates, indicating which line is damaged, then by entering the data received from the hydrometric center, it is possible to determine approximately at what stage it happened.

The application of fuzzy logic does not offer the complete refusal to use expensive means of determining the places of damage, but allows you to refine and speed up the search process without much cost to it.



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КОНКУРЕНТНІ СТРАТЕГІЇ ПІДПРИЄМСТВА: ТЕОРЕТИЧНІ ОСНОВИ

Так, стратегія – це набір специфічних правил та орієнтирів, дотримання яких дає змогу керівництву організації провести об'єднання усіх напрямків управлінської діяльності (процес синергізму) та підпорядкувати їх процесу досягнення спільних цілей. Стратегія являє собою довгострокову програму діяльності господарюючого суб'єкта, яка постійно контролюється, проходить оцінку та коригування в процесі виконання.

На нашу думку, саме стратегічне управління є основним можливим інструментом забезпечення належного рівня ефективності, а від вдалого застосування механізму генерування та

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