Mathematical model specification of the automated control system subject based on the differential approach

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1. The need for the mathematical model specification

From the human factor point of view, an automated control system is reliable when the system’s operator fully meets the requirements set, that is, he is competent. In previously published works aimed at improving the sustainability and reliability of organizational and technical systems, the subject $s \in \{s_1, s_2, \ldots, s_n\}$ was considered as a system of two characteristics: the psychological predisposition $P = \{p_1, p_2, p_3, p_4\}$ of a certain type of activity $D = \{d_1, d_2, d_3, d_4\}$ and the educational characteristic $Q = \{q_1, q_2, q_3, q_4\}$.
1. The need for the mathematical model specification

This approach to the unique personality traits consideration has a number of advantages:

1) First, it uses a modified model of personality psychotype, based on CG Jung's differential psychology, which allows to define a set of basic unique personality traits that determine a psychological predisposition to a certain type activity.

2) Secondly, this approach is very simple for the formal description; indeed, the unique properties of the personality in the form of psychological predisposition are represented by just one set \{P\}. 
1. The need for the mathematical model specification

Nevertheless, it is quite obvious that such approach to the consideration of unique personality traits has a significant drawback: it rather roughly describes the subject's belonging to a certain psychotype, in other words, to a psychological predisposition $p \in \{p_1, p_2, p_3, p_4\}$. 
2. Model of the automated system subject

The specification the model of the automated control system subject based on the differential approach firstly begins with assessing the plausibility of psychological testing results, specification of the fuzzy logic conclusion system for combining various plausibility parameters into a single parameter of test results plausibility, as well as introducing additional parameters to clarify the subject’s unique personality characteristics.
2. Model of the automated system subject

For the analysis, a random sample was generated, in which random people aged from 16 to 49 years from various regions of Russia, such as the Krasnoyarsk Territory, Stavropol Territory, Tomsk Region, St. Petersburg and other regions, took part in the psychological testing. The sample size N was 3367 people (subjects). The results of the time spend for psychological testing are presented in the histogram of frequencies shown in figure 1.
Figure 1. Psychological testing time
Figure 2. Membership functions of the linguistic variable T
2. Model of the automated system subject

A random sample was generated for analysis, in which random people aged from 16 to 49 from various regions of Russia took part in psychological testing. The sample size $N$ was 108 people (subjects). The results are shown in the histogram of frequencies, shown in figure 3.
Figure 3. The value of the psychotype dominant share

Figure 4. Membership functions of the linguistic variable A
Figure 5. Membership functions of the linguistic variable R

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<td>1</td>
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<tr>
<td>2</td>
<td>$\min(\mu_T, \mu_{\text{medium}}) = \mu_{\text{low}}$</td>
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<td>3</td>
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<td>9</td>
<td>$\min(\mu_T, \mu_{\text{high}}) = \mu_R$ very high</td>
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3. Conclusion

1) Statistically reasonable parameters are used, such as the test passing time and the value of the dominant share of psychotype.

2) New additional variables were able to expand the set of unique properties of the subject's personality, and the fuzzy logic conclusion system allowed to work easily with the introduced heterogeneous parameters.

3) This model allows to clarify the result of psychological testing, as well as to assess its plausibility.

It is necessary to continue statistical studies of various test results in order to obtain more substantiated results and discover new patterns.