Materials of Conferences

SIMULATION MODELING OF INFORMATION SECURITY SYSTEMS

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The passage of our society from the post-industrial to informational caused such notion as information environment. Information environment is a subject's field of activity closely related to the creation, transformation and consumption of information. Information security provides the state of information environment protectability. In fact it means informational threat absence and as a result resistance of general human fields of activity to possible dangerous informational influences. Information environment as a fundamental factor of the social activity is a set of conjunct segments that include informational resources, hardware and software means. So comprehension of existing and potential threats to information security objects allows to provide an appropriate security system.

Any informational threat represents some input data, intended for activization of algorithms that break the normal mode of system's functioning in information environment. Separated research of information security threats according to single indices doesn't produce an expected affect, that's why it's necessary to reflect complexly all signs of measuring applying to each threat. As a consequence, it's necessary to use the simulation modeling for complex research of threats to information security.

Simulation models is a combination of traditional mathematical modeling with modern computer technologies. The maximum similarity between the model and real object, and achievement of the maximum exactness of it's description is the purpose of simulation models development.

Simulation models pretend to fulfill explanatory and prognostic functions.

The simulation models are realized by using building block concept that allows to divide the simulation system into several subsystems connected between each other by insignificant quantity of generalized interactions. This subsystems allow independent modeling with the usage of it's own mathematical tool. Such an attitude allows rather simple construction of new simulation models by changing of separated blocks.

So, as stated above, the resolving of problems of information security is based on:

- detailed quantitative analysis of the informational vulnerability in the informatization object;
- scientifically-based determination of the required security level of each object and under concrete conditions of it's functioning;
- creation of optimal security system;

The simulation modeling makes it possible.

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FRICTION LOSS ENHANCEMENT IN ELECTRIC DRIVEN PUMP OF SPACE VEHICLES

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Electric driven pumps (EDP) of low power (N≤300 W) provide circulation of fluid coolant at closed circuit of a temperature-control system (TCS) of space vehicles (SV). Reduction of energy consumption (EDP) is a relevant issue of SV temperature control rationalization.

Let's see the possibility of friction loss enhancement in EDP by way of example of a centrifugal electric driven pump. Let's analyze balance of loss in power in EPD power end not taking into consideration loss in its pump part (fig. 1, pos. I).

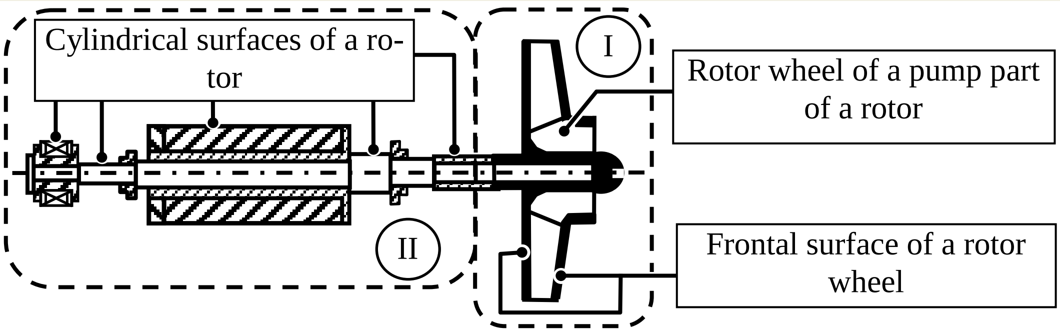

Fig. 1. Structure division of a EPD rotor:
I – pump part of a rotor; II – power end part of a rotor

Total power losses N_{Σ} in EDP electric drive come from several components:

$$N_{\Sigma} = N_{st} + N_{dr} + N_{c} + N_{a},$$

where N_{st} - losses of steel anchor from hysteresis and whirling currents; N_{dr} - friction loss; N_c – loss in copper coil; N_a – added loss while load.

Stator and rotor of EPD SV power end are separated with a case that makes rotor immersion into heat-transfer fluid possible. Because of this rotor's friction loss upon heat-transfer $N_{dr.r}$, being part of friction loss becomes higher:

$$N_{dr} = N_{dr.b} + N_{dr.r},$$

where $N_{dr.b}$ – friction loss in bearings.

EPD SV refer to microsized supercharger in which diameter sizes of pump and power end parts of a rotor are comparable. Friction losses $N_{dr.r}$ on rotor depend on type of rotary surface and consist of 2 components: friction losses upon frontal surfaces of a rotor and friction losses upon cylindrical surfaces of a rotor. In EDP the first type of losses is dominating for a pump part, and the second type –for power end part of a rotor. For EP rotor construction rationalization it is necessary to estimate losses in power from friction upon pump $N_{dr.r}$ separately from power end rotor $N_{dr.r}$.

As an example, illustrating the opportunities of rotor construction optimization, let's analyze friction losses in EDP with electro engine DB-9 и characteristics: pressure H= 60J/kg; consumption of a heat-transfer agent $\dot{V}=140\cdot10^{-6}$ m^3/s and rotating speed n=6000 r/min; clearance gap $\Delta=0.3\cdot10^{-3}$ m; working medium viscosity $\nu=0.7\cdot10^{-6}$ m^2/sec; working medium density $\rho=691$ kg/m^3 ; speed of fluid in a clearance gap between rotor and body $v=15\cdot10^{-6}$ m^3/sec. Calculated value of loss relative density in a pump part of a rotor, including element with the largest diameter – rotor wheel (RW), in the EDP will be $N^{p}_{dr.r}/N_{dr.r}$ =0.844. Thus, the most part of friction losses comes to the pump part of the rotor.

Dependance $(N_{dr.r})_i \sim d^5_{pi}$, points at advisability of decreasing diameter rotor sizes, particularly diameter RW d_{rw}.. One of the constructive methods of decreasing diameter d_{rw} is transition to multistage EDP. Parameter consequence of this becomes coefficient of each stage specific speed n_s growth.

Let's look at the opportunities of decrease $N^{p}_{dr.r}/N_{dr.r}$ by increasing stages of EDP TCS to 2-3, considering that pressure coefficient of each stage will be unchanged , H=0.587.

While transition in EDP from 1 to 2 staged variant d_{rw} should decrease from $32\cdot10^{-3}$ m to $23\cdot10^{-3}$ m, and in 3 staged EDP to $19\cdot10^{-3}$ m. Coefficient of special speed of a stage grows, respectively from n_s=67 to n_s =112 and n_s =152. Relative value of friction loss in a pump part of the rotor $N^{p}_{dr.r}/N_{dr.r}$ with growth of number of stages decreases to 0.677 in 2 staged variant of EDP and to 0.549 in 3-staged EDP, respectively 20% and 35% in comparison to initial level $N^{н}_{тр.р}/N_{тр.р}$ =0.844. Such changes of EDP are acceptable from technical point of view and positive from energetic point of view.

The viewed method of friction loss decrease upon rotor EDP is acceptable for different vaned light-duty machine, for instance compresses and ventilators of aero cosmic significance, radial sizes of rotor driving and force parts of which are comparable. Its realization allows decreasing friction loss upon rotor and decreasing power consumption.

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THE ROTOR-TYPE ARTIFICIAL HEART IMPROVEMENT WITH THE SPACE INSTRUMENT MAKING EXPERIENCE USE

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The American cardiosurgeon M. Debeiky has already described the rotor – type artificial heart structure (RTAH) in the following way[1]: "…this pump has the "Duracell" type ordinary electric battery size, and its efficiency – is 5 – 6 liters blood per a minute. There is only one motion part in the pump, which is called the impeller, and it is being made 10 thousands per a minute".

The RTAH is quite similar with the space rotor – type superchargers, having used in the space vehicles temperature control systems, by their hydraulic characteristics.

[1] The"Michael Debeiky Academitian: I rather like it more to be the ordinary physician, than the mature scientist" paper//The "Izvestiya" newspaper, No.72,it is dated from 19.04.2000, p.7, the last passage in the 1-st column.