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AUTOMATIC CONTROL OF THE ON-BOARD SYSTEMS TECHNICAL CONDITION

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The article considers the issues of automatic control of the technical condition of onboard systems, which consists in the automatic detection of failures in the measurement and control circuits and automatic adaptation to new conditions. It is proposed to use an observation device based on a mathematical model of the vessel to predict the linear and angular movements of the vessel, to compare the true and predicted movements to detect failures in the measurement and control circuits. Previously, the issues of automatic control of the technical condition of onboard systems were considered in [1-3] and others. The use of automatic control modules in vessel automated systems deserves special attention, as it can significantly reduce the impact of the human factor and optimize control processes [4-8].

The control object moves under the external influences of wind, current, waves and controls in the linear and angular motion channel. Parameters of the state vector $\mathbf{X}_l = (V_x, V_y, V_z, X_g, Y_g, Z_g)$ - the components of the velocity and position vector are measured by sensors of the linear motion channel with the clock of information processing in the onboard controller. Parameters of the state vector $\mathbf{X}_a = (\omega_x, \omega_y, \omega_z, \theta, \psi, \varphi)$ - the components of the angular velocity and angular position vector are measured by sensors of the angular motion channel with the clock of information processing in the onboard controller. The parameters of the state vector measured by the sensors of the linear motion channel $\mathbf{X}_{ml} = (V_{mx}, V_{my}, V_{mz}, X_{mg}, Y_{mg}, Z_{mg})$, the parameters of the state vector measured by the sensors of the angular motion channel are fed to the observation device, which is based on a simplified mathematical model of the vessel

$$\dot{\mathbf{X}}_w = \mathbf{f}_n(\mathbf{X}_w, \mathbf{U}(\mathbf{P}_k)) + \mathbf{L}(\mathbf{X}_m - \mathbf{X}_w)$$

The vector of deviations of the state vector parameters estimates from their measured values $\Delta\mathbf{X} = \mathbf{X}_m - \mathbf{X}_w$ is given to the diagnostic unit of failures and adaptation which simplified work is described by system

$$\left\{ \begin{array}{l} FalMS_j = 0, n_j = 0; k_j = 0; \\ |\Delta X_j| \geq \Delta X_j^{\max} \rightarrow n_j = n_j + 1; \\ \xi_j = \frac{n_j}{n_b} \geq \xi_j^{\max} \rightarrow FalMS_j = 1, k_j = k_j + 1; \\ FalMS_j = 1 \rightarrow L(*, j) = 0; \\ FalMS_j = 0 \rightarrow L(*, j) = L_0(*, j); \\ k_j \geq 2 \rightarrow falED_j = 1, FalMS_j = 0. \end{array} \right.$$

The efficiency and effectiveness of the proposed methods, algorithmic and software are tested by mathematical modeling in a closed loop with a control object in the MATLAB environment.

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