

Optimization methods in the theory of vibroprotection

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The theory of vibroprotection uses mathematical approaches of many applied disciplines, including optimization theory and optimal control theory. With the advent of non-typical problems the development of new methods is required. The important direction in evolution of the vibroprotection theory is connected with development of methods and algorithms for solving designing problems for vibroprotection systems. There are some standard problems such as problems of estimation of limit possibilities and synthesis for vibroprotection systems [1, 2].

The designing of vibroprotection systems have to take into account all requirements for this system. These requirements are discrepant. On the one hand the system must ensure the given decrease of the level of dynamic influences. On the other hand it must have restricted overall dimensions. Under given quantitative characteristics of these requirements it's interesting the estimation of the limit possibilities for vibroprotection. At that this estimation does not due to depend on the structure of the vibroprotection system.

Solutions of problems on estimation of limit possibilities for vibroprotection systems can be obtained with help of optimal control theory in the main. At that estimations of limit admissible performance criterion are computed after solution of the correspondent optimal control problem. It's impossible to solve optimal control problems for spatial vibroprotection systems under complex perturbations for the long time period owing to non-additive performance criterion. Thereupon we consider optimal control problems from the position of obtaining limit value for performance criterion, which is answers to optimal control. It's suggested the well-founded mathematical method for computing this limit value under arbitrary perturbation without the requirement to solve the correspondent optimal control problem.

The estimation of the limit possibilities is very important for the initial stage of designing, when we must solve the problem on marketability of the requirements producing for the system. In particular, in a system of design automation this estimation allows to decide the question about expediency of switch to investigation of

the synthesis problem.

For solution of problems on synthesis for vibroprotection systems we propose to apply the method of analytical designing of optimal regulator. This method was generalized for the case of constantly active perturbations: determinate and stochastic. For the the case of determinate perturbations the necessity of conducting of these investigations is conditioned on unrestricted observe period. For the case of stochastic perturbations this necessity is conditioned on absence of quite controllability of the extended system. The approaches for synthesis of vibroprotection systems are developed on basis of the acquired generalizations for analytical designing of optimal regulators. The cost functional of the synthesis problem allows to provide decrease of dynamic influences at the object under execution of overall constraints.

There are some model examples.

References

- [1] A.D. Mizhidon, *Analytical Design of Optimal Controllers under Permanent Stochastic Disturbances as Applied to the Design of Vibration Isolation Systems* // Automation and Remote Control. Vol. 69. No. 4. 2008. Pp. 618-629. ISSN 0005-1179.
- [2] A.D. Mizhidon, *Estimation of the Limit Possibilities of Vibration Isolation Systems* // Automation and Remote Control. Vol. 70. No. 4. 2009. Pp. 699-711. ISSN 0005-1179.