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FAULT ACCOMMODATION IN NONLINEAR AND LINEAR DYNAMIC SYSTEMS: FAULT DECOUPLING BASED APPROACH

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Abstract. *Solution to the problem of fault accommodation in nonlinear and linear dynamic systems is related to constructing the control law which provides full decoupling with respect to fault effects. Special mathematical techniques called algebra of functions complemented by differential geometrical tools are considered to solve the fault decoupling problem. Existing conditions are formulated and calculating relations are given for the control law in nonlinear and linear cases.*
Keywords: Nonlinear dynamic systems, Fault accommodation, Full decoupling, Algebra of functions, Differential geometry

1. **Introduction.** The demand on fault tolerance imposed on critical purpose control systems calls for the use of fault adaptation techniques. Different aspects of the fault tolerant problem solution for different classes of systems were investigated in [5-7,9-11,15].

There exist two principle ways for adaptation to faults [3]. The first one is self-tuning, or fault accommodation. It is related to on-line control law determination that preserves the main performances of the system in faulty case while the minor performances may degrade. The second way is self-organization which involves the system reconfiguration to replace the faulty parts of the system with healthy ones. This paper is concentrated on the fault accommodation problem.

Conventional approach to the above problem solution assumes on-line fault detection and estimation to construct the model of faulty system (so-called model tuning) followed by the new (post-fault) control law determination on the basis of the tuned model [3]. Success in application of such approach depends on fault detection and estimation delay, computational time for the post-fault control law determination and the quality of the post-fault control law. Under this, the quality of the post-fault control law is related to accuracy of the tuned model, while high-accuracy fault estimation to obtain such a model needs in significant time expanses. To improve the situation, the progressive approach to fault accommodation has been proposed in [9]. An idea of this approach is step-by-step model tuning and new control law determination as soon as more perfect information about the faults is obtained.

In the present paper, another approach to fault accommodation is proposed whose unique feature is the use of full decoupling with respect to fault effects in output space of the system. In contrast to the conventional approach, the advantage of this approach