# Synthesis of control system in multidimensional nonlinear objects under uncertainty

Svetlana Kolesnikova⋆

National Research Tomsk State University, Tomsk, Russia skolesnikova@yandex.ru

The problem of generalizing the method of analytical design of aggregated regulators [1] to the case of control of a nonlinear object having an incomplete description is considered. It is assumed that the following conditions are right: 1) there is a global stability of the target system for the initial model, satisfying technical requirements and target invariant manifold; 2) target manifold can be defined analytically; 3) all solutions of the initial system are bounded; 4) control object is represented by a system of ordinary differential or difference equations. The mathematical statement of the problem has the following form [2]:

$$\dot{x}(t) = f(x;u), \Psi(x(t)) = 0, J = \int_0^\infty ((\Psi(x(t))^2 + \omega^2(\dot{\Psi}(x(t)))^2)\,dt \to \min$$

The vectors $x, f \in R^n, u \in R^m, m \leq n$ from (1) are the vectors of state and of control, respectively; some of the components of the vector $f \in R^n$ are unknown; $\Psi(x)$ is target macro variable; $J$ is criterion of quality control. Basic provisions of the algorithm for constructing control of an object with incomplete description are follows.

1. Control structure in accordance with the classical method of analytical constructing of aggregated regulators is formed [1].
2. The replacement of the unknown description with the upper bounds of the state in the regulator is carried out.
3. The task of achieving the set of desired states of the object with simultaneous compensation of uncertainty in the description is posed.
4. An algorithm [2] based on the non-linear adaptation method is used, which guarantees the output of the control object to a neighborhood of the given manifold and the asymptotically stable retention of the object in this neighborhood.

The theoretical justification of the stability and robustness properties of the proposed control algorithm are given.

## References

1. A.A.Kolesnikov: Synergetics and problems of control theory: Collected articles / edited by .. Kolesnikov. FISMATLIT, Moscow, 2004.
2. S.Kolesnikova: Nonlinear regulator with disturbance compensatio. Optoelectronics, Instrumentation and Data Processing, Vol. 51, No. 4, 2015. [DOI: 10.3103/S8756699015040111]

⋆ This work was supported by grant 17–08–00920 from the RFBR