Dynamics of Continuous, Discrete and Impulsive Systems
Series **A:** *Mathematical Analysis* **11 (2004)** 205-217

DIRECT LIAPUNOV'S MATRIX FUNCTIONS METHOD AND OVERLAPPING DECOMPOSITION OF LARGE SCALE SYSTEMS

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To the 70th birthday of Professor D.D.Šiljak

Abstract. In the framework of the method of matrix-valued Liapunov functions stability problems are considered for the dynamical system extended (reduction) in terms of a linear transformation. The examples are presented which show how generalized decomposition together with matrix-valued function extend the possibilities of application of the second Liapunov method in stability investigation of dynamical system.
Keywords. Large scale systems; overlapping decomposition; Liapunov's matrix function; stability; asymptotic stability.
Mathematics Subject Classification (2000): 93A15, 93D05; 93D30.

1 Preliminary results

Let the system of perturbed motion equations

$$S_x\colon\ \ \frac{dx}{dt} = f(t,x), \qquad x(t_0) = x_0, \tag{1.1}$$

be given, where $x \in R^n$ and $f \in C(R_+ \times R^n,\, R^n)$, which possesses under initial conditions $(t_0, x_0) \in \operatorname{int}(R_+ \times R^n)$ a unique solution $x(t) = x(t; t_0, x_0)$ determined for all $t \geq t_0,\ t_0 \geq 0$.

Together with system (1.1) we consider a nonlinear continuously differentiable transformation $[1, 2]$

$$y = \Phi(t,x), \quad \Phi \in C^{(1,1)}(R_+ \times R^n,\, R^m) \tag{1.2}$$

for which a reverse one exists and is determined by the formula

$$x = \Pi(t,y), \quad \Pi \in C^{(1,1)}(R_+ \times R^m,\, R^n). \tag{1.3}$$

Using (1.2), and (1.3) we reduce system (1.1) to the form

$$S_y\colon\ \ \frac{dy}{dt} = \tilde f(t,y), \qquad y(t_0) = \Phi(t_0, x_0), \tag{1.4}$$