E. I. Atamas (Moscow, Lomonosov Moscow State University (MSU)). **On input estimation problem for linear time-delay systems and corresponding functional equations.**

Key words: input estimation, feedback, control system, time-delay systems, functional equations, polynomial approximation.

We consider a linear multidimensional system with commeasurable delays

$$\begin{cases} \dot{x} = \sum_{i=0}^{k} A_i x(t - i\tau) + \sum_{i=0}^{k} B_i \xi(t - i\tau), \\ y = \sum_{i=0}^{k} C_i x(t - i\tau) + \sum_{i=0}^{k} D_i \xi(t - i\tau), \end{cases} \tag{1}$$

with $x(t) \in \mathbf{R}^n$ — state of the system, $y(t) \in \mathbf{R}^l$ — measured output, $\xi(t) \in \mathbf{R}^m$ ($l \geqslant m$) — unknown input. The initial functions are unknown, but guarantee existence and uniqueness of solution.

Our primary goal is to find in real time an estimation $\widehat{\xi}(t)$ for unknown input $\xi(t)$, such that $|\xi(t) - \widehat{\xi}(t)| \to 0$ when $t \to \infty$. This problem is also called a system inversion problem [1]. In order to solve this problem we consider system (1) as a linear system over commutative ring $\mathbb{R}[x]$ and develop a special form for such systems. Unfortunately, not every system can be transformed to this form directly by linear mapping. One of possible ways to overcome this limitation requires solving continuous time difference equation of the form

$$\sum_{i=0}^{k} a_i \, y(t - i\tau) = f(t), \tag{2}$$

with constant coefficients $a_i \in \mathbf{R}$.

Although theory for such equations is well developed [2], existing methods are hardly applicable in our situation. So a new polynomial approximation-based method is developed and it's properties are investigated. We also estimate influence of approximation error on the inversion algorithm in whole.

REFERENCES

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