RESTORING THE PARAMETERS OF CONJUGATED PAIRS OF LINEAR ALGEBRAIC EQUATION SYSTEMS BY A SET SOLUTION [1]

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The report observes the theorem of recovering the parameters of a conjugated pair of linear algebraic equation systems by a set solution using an interval criterion.

Theorem. *The $A \in \mathbf{R}^{m\times n}$ family of matrices and the $b \in \mathbf{R}^m$, $c \in \mathbf{R}^n$, families of vectors that guarantee that the set $\bar{x} \in \mathbf{R}^n$ and $\bar{u} \in \mathbf{R}^m$ vectors belong to the*

$$\begin{cases} Ax = b, \\ u^\top A = c^\top, \end{cases}$$

set of solutions of a conjugated pair of systems of linear algebraic equations, and at the same time, $\|A\| \le \alpha$, $\|b\| \le \beta$, $\|c\| \le \gamma$, where $\alpha > 0$, $\beta > 0$, $\gamma > 0$ can be constructed using

$$b = \lambda\frac{\bar{u}}{\bar{u}^\top\bar{u}} + \lambda\left(I_m - \frac{\bar{u}\bar{u}^\top}{\bar{u}^\top\bar{u}}\right)\Delta b,\ c = \lambda\frac{\bar{x}}{\bar{x}^\top\bar{x}} + \lambda\left(I_n - \frac{\bar{x}\bar{x}^\top}{\bar{x}^\top\bar{x}}\right)\Delta c,\ A = \frac{1}{\lambda}bc^\top,$$

formulas, where $\|\cdot\|$ stands for, depending on the content, the Euclidean matrix or vector norm, the scalar parameter λ is calculated using the

$$\lambda \le \bar{\lambda} = \min\left(\frac{\alpha}{\bar{\alpha}}, \frac{\beta}{\bar{\beta}}, \frac{\gamma}{\bar{\gamma}}\right),$$

rule,

$$\bar{\beta} = \sqrt{\frac{1}{\bar{u}^\top\bar{u}} + \Delta b^\top\left(I_m - \frac{\bar{u}\bar{u}^\top}{\bar{u}^\top\bar{u}}\right)\Delta b},\quad \bar{\gamma} = \sqrt{\frac{1}{\bar{x}^\top\bar{x}} + \Delta c^\top\left(I_n - \frac{\bar{x}\bar{x}^\top}{\bar{x}^\top\bar{x}}\right)\Delta c},\quad \bar{\alpha} = \bar{\beta}\cdot\bar{\gamma},$$

$\Delta b \in \mathbf{R}^m$, $\Delta c \in \mathbf{R}^n$ are random vectors, I_m, I_n are singular matrices of size m and n, accordingly.

At the same time $\|A\| = \lambda\cdot\bar{\alpha}$, $\|b\| = \lambda\cdot\bar{\beta}$, $\|c\| = \lambda\cdot\bar{\gamma}$.

The report ends with a numerical experiment with a model example.

[1]The project was completed with support from The Russian Foundation for Basic Research (project № 14-01-31318)