© 2013 FIZ Karlsruhe

io-port 05066090

Bai, Zheng-Jian; Morini, Benedetta; Xu, Shu-Fang

On the local convergence of an iterative approach for inverse singular value problems.

J. Comput. Appl. Math. 198, No. 2, 344-360 (2007).

Consider the following inverse singular value problem: Given n real $m \times n$ matrices $(A_i)_{1 \le i \le n}$, $m \ge n$, and n real numbers $\sigma_1^* > \sigma_2^* > \cdots > \sigma_n^* > 0$; find a vector $c = (c_i)_{1 \le i \le n}$ such that the singular values $\sigma_i(c)$, $1 \le i \le n$, of the matrix $A(c) = \sum_{1 \le i \le n} c_i A_i$ are precisely σ_i^*, $1 \le i \le n$. Let $\Sigma_* = \mathrm{diag}(\sigma_1^*, \sigma_2^*, \cdots, \sigma_n^*) \in \mathbb{R}^{m \times n}$, and $\mathcal{O}(n)$ denotes the set of all orthogonal matrices in $\mathbb{R}^{m \times n}$. With :

$$\mathcal{A} = \{\ A(c);\ c \in \mathbb{R}^n\},\ M(\Sigma_*) = \{\ U \Sigma_* V^T;\ U, V \in \mathcal{O}(n)\};$$

the current iterate c^k , and $X_k = U_k \Sigma_* V_k^T \in M(\Sigma_*)$, the authors prove that there exists:

$$\varepsilon > 0;\ \tilde{c} \in \mathbb{R}^n;\ \tilde{U}, \tilde{V} \in \mathcal{O}(m),$$

such that, if $\|c^\circ - c^*\| \le \varepsilon$, the iterates c^k, U_k, V_k, $U_k^T A(c^k) V_k$ converge to

$$\tilde{c}, \quad \tilde{U}, \quad \tilde{V}, \quad \tilde{U}^T A(\tilde{c}) \tilde{V} = \Sigma_*;$$

and correct a paper of *M. T. Chu* [SIAM J. Numer. Anal. 29, No. 3, 885–903 (1992; Zbl 0757.65041)].

Bui Doan Khanh (Paris)

Keywords: inverse problems; singular values; root-convergence rate; Newton method
doi:10.1016/j.cam.2005.06.050