On the convergence of the Jacobi-type method for computing orthogonal tensor decomposition

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Tensor decompositions are a central problem of numerical multilinear algebra. For a general third-order tensors $\mathcal{A} \in \mathbb{R}^{n \times n \times n}$ we are looking for its SVD-like decomposition

$$\mathcal{A} = \mathcal{S} \times_1 U \times_2 V \times_3 W,$$

where U, V, W are orthogonal $n \times n$ matrices and $\mathcal{S}$ is an $n \times n \times n$ tensor such that

$$\|\mathrm{diag}(\mathcal{S})\|^2 = \sum_{i=1}^{n} \mathcal{S}_{iii}^2 \to \max .$$

To obtain this decomposition we are using the alternating least squares approach and a Jacobi-type method. The algorithm works on $2 \times 2 \times 2$ subtensors. In each iteration the sum of the squares of two diagonal entries is maximized using Jacobi rotations. We show how the rotation angles are calculated and prove the convergence of the algorithm. Moreover, we discuss different initializations of the algorithm.