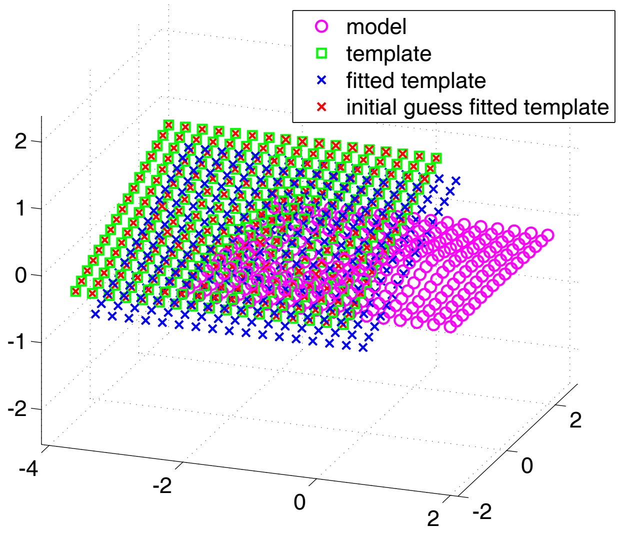

Fig. 3. Third test

$$\mathbf{X} = \begin{bmatrix} 0.9996 & -0.0003 & 0.0066 & -1.8861 \\ 0.0005 & 0.9547 & -0.3026 & 1.0927 \\ 0.0008 & 0.2953 & 0.9513 & 0.1058 \\ 0 & 0 & 0 & 1.0000 \end{bmatrix} \quad (46)$$

$$\mathbf{T}_r\mathbf{x} = \begin{bmatrix} 0.9996 & -0.0003 & 0.0066 & -1.9004 \\ 0.0005 & 0.9547 & -0.3026 & 1.1008 \\ 0.0008 & 0.2953 & 0.9513 & 0.0990 \\ 0 & 0 & 0 & 1.0000 \end{bmatrix} \quad (47)$$

The numerical results depicted by (45), (46) and (47), underlines the accuracy of the ICP problem solution when a robust initial guess is considered. This shows the usefulness of the proposed method, combined with the remark that tensorial approach has the capability of generating the initial guess very close to the ground truth. This will be exploited in future work when different applications, one being motion estimation, will be considered.

VI. Conclusions

This paper presents a new method for finding the initial guess to the Iterative Closest Point problem. The proposed method is based on the motion parameterization properties of orthogonal dual tensors. Using an isomorphism between the special euclidean group SE_3 and the orthogonal dual tensors group $\underline{S\mathbb{O}}_3$, a set of conditions are drawn in order to ensure the existence of closed-form simultaneous solutions for data that contains any number of elements for two set of points that need to be register. The solutions are free of coordinates and can easily be put into practice through a step by step implementation algorithm. Numerical simulations show that our solutions are accurate and robust even when noisy data are considered or singularity situations are analyzed.

Future work will include extended performance evaluation of the proposed solution when real data from sensors such as stereo vision or RGB-D.

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