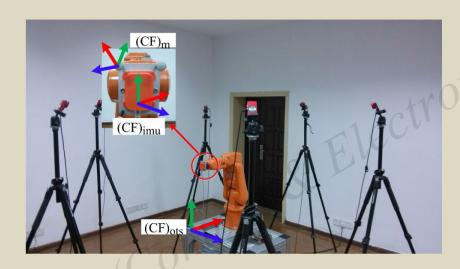
Design method (II)

System setup:

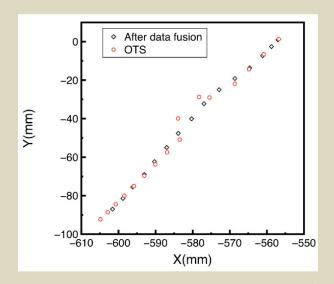


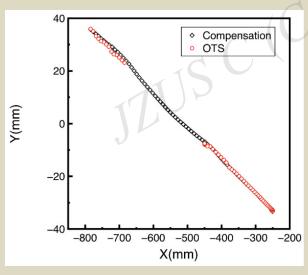
The data from OTS and IMU is used to estimate the position x_p and orientation x_0 of the robot's end effector using the Kalman filter. The discretized transition equations of the state space models are

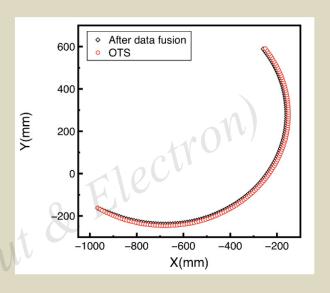
$$\begin{bmatrix} \boldsymbol{x}_{\mathrm{p}}(k) \\ \boldsymbol{x}_{\mathrm{p}}'(k) \\ \boldsymbol{x}_{\mathrm{p}}''(k) \end{bmatrix} = \begin{bmatrix} 1 & \Delta T & \Delta T^{2} / 2 \\ 0 & 1 & \Delta T \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \boldsymbol{x}_{\mathrm{p}}(k-1) \\ \boldsymbol{x}_{\mathrm{p}}'(k-1) \\ \boldsymbol{x}_{\mathrm{p}}''(k-1) \end{bmatrix}, \quad \begin{bmatrix} \boldsymbol{x}_{\mathrm{o}}(k) \\ \boldsymbol{x}_{\mathrm{o}}'(k) \end{bmatrix} = \begin{bmatrix} 1 & \Delta T \\ 0 & 1 \end{bmatrix} \begin{bmatrix} \boldsymbol{x}_{\mathrm{o}}(k-1) \\ \boldsymbol{x}_{\mathrm{o}}'(k-1) \end{bmatrix},$$

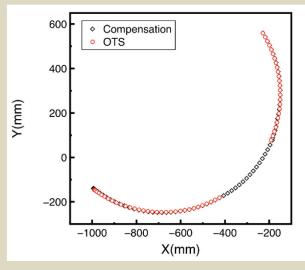
where ΔT is the sampling time of the discretization.

Experimental results









Conclusions

- A robust optical-inertial data fusion system is proposed for motion tracking of the robot manipulator.
- Based on the evaluation of error distribution of OTS, a Kalman filter with a dynamic covariance is developed for data fusion.
- The capability of the developed approach is proved by several experiments, and the performance of OTS is improved in terms of accuracy and reliability.