



Estimation of Forefinger Motion with Multi-DOF Using Advanced Kalman Filter

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Abstract: Data from the World Health Organization (WHO) of the year 2016 recorded that stroke cases were ranked second as a non-communicable disease that causes death, and the third leading cause of disability worldwide. Stroke can cause disability or weakness on one side of the body, including the upper limbs such as the fingers being difficult to move, so rehabilitation is required to restore the function of the hand. A finger arm robot is one solution to help accelerate the rehabilitation process specifically for finger movements. One of the efforts to develop a finger robot is finger motion estimation. It is started with the inverse kinematic modeling of the finger arm robot with 3 joints matching the structure of a human finger. One reliable estimation method frequently used is the Advanced Kalman Filter method. In this paper, the Advanced Kalman Filter is divided into two methods, that is, the Ensemble Kalman Filter (EnKF) and the Ensemble Kalman Filter Square Root (EnKF-SR). The focus of this paper is to estimate the fingers, especially the index finger of the left hand, using the EnKF and Square Root EnKF (SR-EnKF) methods. And, the simulation results show that both methods reached an accuracy of 99% when 400 ensembles were generated on a semicircular path by the EnKf-SR with lower error.

Keywords: *finger arm robot; EnKF; SR-EnKF; finger motion estimation.*

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