論　文　要　旨
Thesis Abstract

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主論文題名　（Title）

Estimation of Transition Frequency Phase of Postural Coordination during Continuous Support Surface Translation

内容の要旨　（Abstract）

Depending on task requirements, a human is able to select distinct strategies such as the use of an ankle strategy and hip strategy in order to maintain their balance. Postural control actions often co-occur with other movements and such movements may bring about a change from one type of postural coordination to another. The selection of a postural control strategy has typically been investigated by the transition of Center of Mass (COM), Center of Pressure (COP) and in between angle joint motion along with their characteristics. In this research, we proposed a method using the logistic function of the sigmoid model based on cross-correlation coefficient (CCF) data for investigating and observing the transition of postural control strategies of COM-COP and ankle-hip angles towards anterior-posterior (AP) continuous translation perturbation. Subjects were required to stand on the motion base platform where perturbation; with an increasing frequency (0.2 Hz to 0.8 Hz) and decreasing frequency (0.8 Hz to 0.2 Hz) in steps of 0.02Hz, was induced. As the frequency increased, the COM and COP displacement were decreased, with the opposite trend observable with decreasing frequency. Meanwhile, ankle and hip angular displacements were increased during increasing frequency and decreased during decreasing frequency. In this paper, the proposed sigmoid model could identify the transition frequency of COM-COP and ankle–hip transition. The mean transition frequency of COM-COP during increasing frequency was 0.50 Hz, and the ankle–hip transition frequency was 0.50 Hz. Meanwhile, for decreasing frequency, the COM-COP transition frequency was 0.53 Hz and for ankle-hip transition frequency was 0.56 Hz. With frequencies; both increasing and decreasing; the COM-COP and ankle-hip transition frequencies were occurred almost at the same frequency. Furthermore, the transition occurred in a lower time scale during increasing frequency compared to decreasing frequency. Vision manipulation was also take into consideration in this study. The absence of vision sensory causing an increased in COP and COM sway compared to eyes open. The mean transition frequency of COM-COP during increasing frequency was 0.48Hz, and the ankle–hip transition frequency was 0.43 Hz. Meanwhile, for decreasing frequency, the COM-COP transition frequency was 0.48 Hz and for ankle-hip transition frequency was 0.52 Hz. In conclusion, the continuous translation surface perturbation provided information on the behavior of postural control strategies. A

sudden change in ‘phase angle’ was observed where either an ankle or hip strategy were implemented to maintain balance. Besides, the transition frequency of postural control strategies could be determined to occur between 0.40 Hz and 0.60 Hz for healthy young subjects in the AP plane. Manipulation of visual information have no significant effect towards transition frequency phase value. Furthermore, the proposed sigmoid model was believed to be able to be used in the determination of transition frequency in postural control strategies.

Keywords: postural control strategies; sigmoid function; cross-correlation coefficient; continuous support surface translation perturbation; kinematics; kinetics; transition, vision

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