Study on Acceleration Coordination during Dribbling in Soccer

Wataru Ichikawa*, Takato Abe, Satoru Kizawa, Ayuko Saito

Department of Mechanical Science and Engineering, Kogakuin University, Japan
E-mail: s520007@ns.kogakuin.ac.jp

Abstract

In this study, the singular value decomposition of acceleration was used to quantitatively clarify the coordination of the limbs during dribbling. The results showed that the coordination in the right and left forearms, thighs, and lower legs was confirmed.

Soccer is a sport in which players compete to score points by shooting the ball into the opposing team's goal. Currently, the number of soccer players in Japan is approximately 4.36 million, with about 800,000 active players. It is essential for players, both professional and amateur, to acquire various skills in order to be successful in the game. An evidence-based training method enables players to practice effectively and to prevent injury.

This study focuses on dribbling which is the basic motion during soccer game. In order to elucidate the mechanism of dribbling motion, several researches have been investigated the sprinting activities during dribbling [1]. This study investigates the acceleration of forearm, thigh, and lower leg during dribbling and analyze the acceleration coordination.

An adult male (height 1,8m, weight 68kg) participated in the experiment. After receiving an explanation of the purpose and requirements of the study, the participant gave his written informed consent to participate. Study approval was obtained from the Research Ethics Board, Kogakuin University.

As shown in Figure 1, a total of six 9-axis motion sensors were attached to the participants' forearms, thighs, and lower legs. He dribbled a ball through five cones placed at equal intervals on either side. After measurement, each acceleration sensor output was converted into dimensionless quantities of -1 to 1. The observation matrix consisted of dimensionless quantities of acceleration data. A singular value decomposition was performed and the observation matrix was decomposed into the basis vectors.

The results of the spatial basis patterns obtained by singular value decomposition are shown in Figure

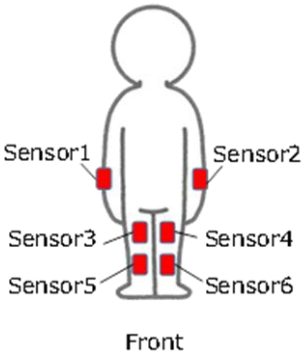
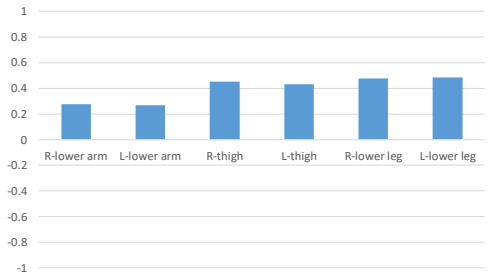
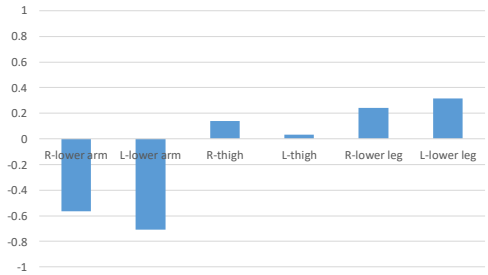


Fig. 1. Sensor positions



(a) Results of mode 1 (97%)



(b) Results of mode 2 (2%)
Fig.2 Spatial coordination patterns

2. Figure 2(a) shows the results for the first mode with a 97% contribution rate, and Figure 2(b) shows the results for the second mode with a 2% contribution rate. The results showed that the right and left forearms, thighs, and lower legs coordinated with each other. The right and left coordination was stronger in the order of lower legs, thighs, and forearms. The contribution of the second mode is 2%, which was not the dominant mode of motion for dribbling, suggesting that it is for fine-tuning the motion. The results described that the participant dribbled while fine-tuning the movements of their left and right forearms.

In this study, the singular value decomposition of acceleration was used to quantitatively clarify the coordination of the limbs during dribbling. The results showed that the coordination in the right and left forearms, thighs, and lower legs was confirmed

References:

[1] Y. Muranoshi, S. Nakahira, T. Yamaoka, Y. Kitazima, R. Isano, K. Aoyama, *Study on the rising sprinting motion of dribbling in soccer*, **26**, 2 267-271(2013)