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### Analyzing the motions of the soccer throw-in using inertial sensors

J.G.Neville, D.A.James and D.D.Rowlands<sup>\*</sup>

*<sup>\*</sup>Corresponding Author: Centre for Wireless Monitoring and Applications, Griffith University, Nathan, Brisbane, Australia,  
Email: d.rowlands@griffith.edu.au*

The biomechanical processes of a soccer throw-in can be analyzed using a combination of accelerometers and gyroscopes. The biomechanics of a running soccer throw-in have been well studied and it has been established in previous work [1] that the rotation of the distal segments and the torso along with the forward velocity from a running approach contribute to the characteristics of the soccer throw-in. This paper explores the repeatability of the motions of a soccer throw-in along with an examination of the release velocity of the soccer ball and its relationship to the inertial sensor data.

Inertial sensor data was recorded at the sacrum and the wrist for a running throw-in. Vicon, a motion capturing system was used to match the motion with the inertial sensor output and determine the release velocities of each soccer throw-in. MATLAB was used to extract the acceleration of the wrist at ball release and to correlate the data provided for multiple trials to determine repeatability.

A Pearson's correlation test was conducted for multiple trials from a participant producing minimum correlation coefficients for each of the distinct motions. The minimum correlation coefficient was calculate for the wrist motion ( $RHO = 0.96$ ), the torso rotation ( $RHO = 0.95$ ) and for the body acceleration ( $RHO = 0.85$ ). The release velocity was found to be linear with respect to the wrist acceleration with a correlation coefficient of 0.862. These results demonstrated how inertial sensors can be used to analyze the motions of the soccer throw-in.

[1] "The Impact of Technology on Sport III", Editors F. Alam, L. V. Smith, A. Subic, F. K. Fuss and S. Ujihashi, J.G. Neville, D.A. James, D.V. Thiel, D.D. Rowlands," Using Inertial Sensors To Examine The Soccer Throw-In", pp 611 - 615, 2009

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