COMPUTATIONAL FRAMEWORK for Biomechanical Analysis of Tennis Players

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Introduction

Recently, several researcher groups have developed and implemented methodologies and systems for biomechanical analysis of athletes in sports activities with the aim of improving their athletic performance, as well as reducing the risk of injuries. Particularly focus has been given to the analysis of the movements performed by tennis and badminton players [1].

For example, in [2] is presented a study concerning the biomechanical analysis of tennis shots based on an analogy with handball throws, since the difference involved is the tennis racket that can be addressed as an additional body segment with the adequate inertial and elastic characteristics. In the study presented in [3] we can find a description of the effects of racket inertia tensor and its influence on the elbow loadings and swing torques for central and eccentric impacts.

In the last years, we have developed a computational framework for biomechanical analysis of tennis players; particularly, for the analysis of several biomechanical parameters associated to the performing of tennis strokes.

The framework includes an Arduino platform and a biomechanical model of the upper limb for tennis players, which was developed in *OpenSim*. The Arduino platform considers the data acquired by different kinds of sensors, including: pressure sensors; piezoelectric vibration sensors; inertial sensors placed on the frame of the tennis racquet; two elastic bands placed on the elbow and wrist to perform the direct measurement of movement angles. Two electromyography sensors (EMG) are also included to assess the electrical activity of the *Biceps* and *Triceps* muscles, Figure 1. The data acquisition is performed in real time.

The interface of the framework developed consists of various menus organized by tabs, which allow the visualization of the biomechanical parameters under analysis.

The framework developed intends to be a helpful tool for researchers and players in order to improve tennis performance and avoid injuries. Currently, the framework is under evaluation in real application scenarios.

References

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[3] Steven M. Nesbit, "The Effects of Racket Inertia Tensor on Elbow Loadings and Racket Behavior for Central and Eccentric Impacts", Journal of Sports Science and Medicine 5:304-317, 2006.
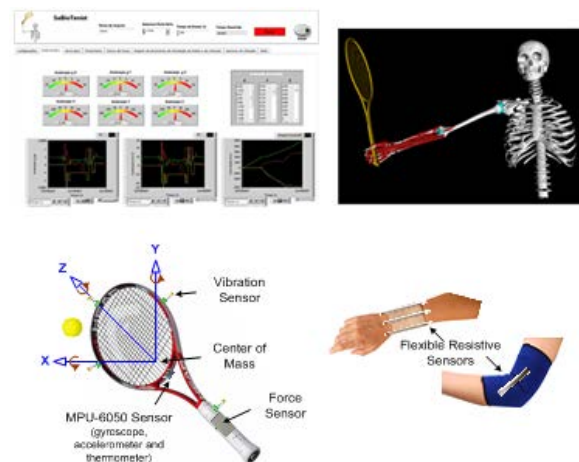
Figures

Figure 1 – Computational framework developed for the biomechanical analysis of tennis players.