

Development and selection of balance sensing devices

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Octavian A. Postolache ; Gabriela B. Postolache

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Abstract:Balance is required for many functional activities of daily life. Qualitative or quantitative balance assessment is frequently used in the diagnosis of neuro-muscular diseases, in treatment or therapy monitoring, and for performance assessment in sports training programs. In the last years, various technologies were developed for balance or posture analysis with the main focus on sensors and reliability of the measurements. We discuss the questions related with the development of a balance assessment system, which might facilitate the design or selection of components for balance sensing and training.

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Introduction

In human biomechanics, balance is defined as the ability to keep the body's center of mass (COM) within the limits of the base of support [1]. The generic term balance indicates the dynamics of body posture to prevent falling. It is related to the inertial characteristics of body segments and the inertial forces acting on the body. Maintaining balance during a certain body posture depends on the muscle-skeletal characteristics, a rich and fine integration of many sensorimotor processes in our body, functionality of nervous system motor control, the goal one is trying to accomplish, and the surrounding environment. We take for granted good balance when we have no difficulty getting out of bed or rise from a chair without stumbling, or when we walk in stable equilibrium across a gravel driveway. However, with impaired balance many functional activities of daily life that require mobility and fall avoidance are realized with higher perceived effort and are sometimes dangerous. Balance impairment is produced in many neuro-musculoskeletal disorders (e.g., vestibular deficits, cerebellar diseases, stroke, cerebral palsy, scoliosis, Parkinson's disease, peripheral neuropathies, amputation). Various degrees of impaired balance have been described in elderly people [2], [3]. Assessment of balance abilities is important for the diagnosis of potential impairment in postural control [4], evaluation and monitoring of physical exercise training effects [5], identifying fall risk [6], and forecasting mortality risk [7].

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