

EMPLOYMENT OF DIGITAL HUMAN MODELS IN THE EVALUATION OF ASSISTIVE WALKING AIDS FOR ELDERLY USERS

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Abstract: *Increasing age is often associated with a rise in other impairments, such as osteoarthritis, reduced hearing and vision or general frailty, leading to mobility problems. Thus, it results the need for specially designed products, most commonly solved by assistive technologies, the employment of which enables independent functioning, yet, issues of usability, safety and acceptance remain to be solved. The use of digital human models (DHM) is one of the most common techniques employed in testing and improving certain features of a system or product. Taking into consideration these factors, this paper proposes the usage the Human Builder module in CATIA V5 in order to develop two human models, generated with anthropometric data collected from a group of over 65 years old participants, residents in an assistive care center. The models are further employed in testing the safety and comfort level of the most commonly used walking aids currently considered by the participants.*

Keywords: *elderly users, digital human modeling*

1. Introduction

Regarding the elderly population, mobility problems are the ones that raise the most concerns. For most of them, solving the problems imposed by a low mobility can make the difference between the active participation in daily life activities or social exclusion.

As a result of ageing, several changes may occur, such as modifications in muscles and joints, flexibility, strength, posture and gait (muscle atrophy of the limbs and torso, osteoporosis, susceptibility to failure due to orthostatic hypotension in the case of Parkinson's) [1,2]. In the same manner, changes in the central nervous system can cause a slow reaction time, interfering with the person's ability to interact with the working environment [3].

Statistical data show an aging tendency in the countries of the European Union, underlining an increase in the over 65 years age group from approximately 17.5% in 2011 to an estimated 26.9 % in 2040 [4]. Thus, the need for developing new assistive devices to

better benefit the physical constraints imposed by the aging process arises.

Particularly, considering the aging population, gait stability is one of the major risk factor in terms of falls, the term including both direct and indirect aspects biomechanical stability while walking [5].

In [6], a gait study shows a correlation between walking stability and balance during walking in older adults. The adaptations create a more stable but less effective walking pattern. Furthermore, the increased gait-stability ratio indicates that older adults must take more steps per unit of distance in order to maximize the walking stability.

An ample study regarding gait stability and falls assessment was considered in [7] in order to evaluate the sensitivity of biomechanical measures that quantify gait stability in elderly population. The study classifies the falls risk factors into three groups - environmental, task-related and personal factors, underling that, from the multitude of factors, gait stability