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# Feasibility of a Gait Phase Identification Tool for Transfemoral Amputees Using Piezoelectric-Based In-Socket Sensory System

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## Abstract

Gait detection is crucial especially in active prosthetic leg control mechanism. Vision system, floor sensors, and wearable sensors are the popular methods proposed to collect data for gait detection. However, in active prosthetic leg control, a tool that is practical in its implementation and is able to provide rich gait information is important for effective manipulation of the prosthetic leg. This paper aims to ascertain the feasibility of the piezoelectric-based in-socket sensory system that is hypothesized to be practical in implementation and provide sufficient information as a wearable gait detection tool for transfemoral prosthetic users. Fifteen sensors were instrumented to the anterior and posterior internal wall of a quadrilateral socket. One transfemoral amputee subject donned the instrumented socket and performed two walking routines; single stride and continuous walking. The sensors' responses from both routines were analyzed with respect to the gait phases. The results suggested that the sensors output signal corresponds to the force components behavior of the stump while performing gait. All sensors were seen active during the first double support period (DS1). The anterior sensors were prominent during the initial swing (Sw), while posterior sensors were active during terminal Sw. These findings correspond with the muscle activity during the respective phases. Besides, the sensors also show significant pattern during single support and the second double support (DS2) phase. Thus, it can be deduced that the proposed sensory system is feasible to be used as a gait phase identification tool.

## Keywords

Author Keywords: [Gait analysis](#); [sensory system](#); [prosthetic](#); [piezoelectric](#); [transfemoral](#)  
KeyWords Plus: [MUSCLE FORCES](#); [WALKING](#); [RECOGNITION](#); [PRESSURE](#); [PATTERN](#); [EMG](#)

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