SENSING DYNAMIC INTERACTION WITH THE ENVIRONMENT

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INTRODUCTION
Study of the dynamic interaction with the environment and loading of the human body is important in ergonomics, sports and rehabilitation. This paper presents a method to estimate power transfer between the human body and the environment during short interactions and relatively arbitrary movements using a combination of inertial and force sensing.

METHODS
Power transfer between two bodies is given by:

\[ P = \vec{F} \cdot \vec{v} + \vec{M} \cdot \vec{\omega} \]  

(1)

Performed work follows by integrating power over time. Angular velocity \( \vec{\omega} \) can be measured using rate gyroscopes, velocity \( \vec{v} \) can be estimated from accelerometers after rotation to the inertial coordinate system, subtraction of gravitational acceleration, integration and applying adequate start and end conditions. Force \( \vec{F} \) and moment \( \vec{M} \) can be sensed by a 6 DOF force/moment sensor system [1] (Figure 1).

RESULTS
An example result is shown in figure 2. The mass is transferred from the ground to a 75 cm high table, accounting for a potential energy change of 69 J. The estimated performed work in this case is 70 J.

DISCUSSION
The presented method also allows partial characterization of the dynamic characteristics of unknown loads.

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REFERENCES