

# Mechanical Engineering Master's Defense

Load Carrying Assistance Device:  
Pogo Suit

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## abstract

Wearable robots including exoskeletons, powered prosthetics, and powered orthotics must add energy to the person at an appropriate time to enhance, augment, or supplement human performance. Adding energy while not being in sync with the user can dramatically hurt performance which is why it is necessary to have correct timing with the user. Many human tasks such as walking, running, and hopping are repeating or cyclic tasks. A method has been developed to add energy at the appropriate time to the repeating limit cycle based on a phase oscillator. The phase oscillator eliminates time from the forcing function which is based purely on the motion of the user.

This approach has been simulated, implemented and tested in a robotic backpack which facilitates carrying heavy loads. The device oscillates the load of the backpack, based on the motion of the user, in order to add energy at the correct time and thus reduce the amount of energy required for walking with a heavy load. Models were developed in Working Model 2-D, a dynamics simulation software, in conjunction with MATLAB to verify theory and test control methods. The control system developed is robust and has successfully operated on a range of different users, each with their own different and distinct gait. The results of experimental testing validated the corresponding models.



November 17, 2014; 4:00 PM; ERC 490