VISVESVARAYA TECHNOLOGICAL UNIVERSITY

BELGAUM – 590 014

A Project Report on

"EXPERIMENTAL STUDY OF EXOSKELETON FOR ANKLE AND KNEE JOINT"

Submitted in partial fulfilment for the award of

BACHELOR OF ENGINEERING

In

MECHANICAL ENGINEERING

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2010-2014

ABSTRACT

The idea of this study was to develop a portable device capable of providing ankle joint mechanical assistance during walking without using external power from onboard actuators (i.e. an 'energy-neutral' solution). Human walkers exploit a key passive dynamic principle of locomotion: elastic energy storage and return. Early in stance, strain energy is stored in the Achilles' tendon and then it is recovered later, providing mechanical work during push-off.

We hypothesize that a passive wearable device using parallel elastic elements during the walking cycle is capable of recycling a significant portion of the ankle joint mechanical work and could reduce the metabolic cost of walking.

Our goal was to provide all of the benefits of an actively powered exoskeleton but in a portable framework without motors or an external energy source to provide an ease in the gait cycle. We set out to develop a passive, 'energy-neutral' system with the following key design objectives:

(1) Deliver torque to the ankle following a pattern similar to the normal joint moment during walking and

(2) Recycle elastic energy during the stance phase while allowing free ankle rotation during swing.

The subject matter described herein includes an apparatus and a clutch for using controlled storage and release of mechanical energy to aid in locomotion. One exemplary apparatus includes a frame including an upper portion configured to mechanically couple to a leg of the subject on a calf side of an ankle joint of the subject and a lower portion pivotally attached to the upper portion configured to mechanically couple to a foot of the subject on a foot side of the ankle joint of the subject. The apparatus include a rotary clutch and an elastic element coupled between the upper and lower portions of the frame to control periods of energy storage and release by the elastic element. This apparatus will greatly benefit the rehabilitation process of stroke patients, cerebral palsy patients, general recuperation etc