NORTHERN ARIZONA UNIVERSITY

Team Name:

Team 19F03 – Hip A

Team Members:

Lahdan Alfihan

Meshal Alghammas

Abdullah Almarri

Mohammed Janshah

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Instructor:

Dr. David Trevas

1. Introduction:

Majority of tasks conducted were those that aimed at improving the exoskeleton final assemblies of parts to the exoskeleton and testing. At this point of implementation testing is done alongside to ensure that the parts included coincide with the intended objectives and that they all work harmoniously to deliver the intended purpose.More keenness is given to the type of connections which range from welds to use of shaft weld to use of adhesives such as metal epoxies.

2. Implementation:

Progressive work on the exoskeleton involved joining of metallic parts together as schedule to finalize the structure. Joining of the parts is by use of bolts and joints, use of adhesives and also welding together. In this case the joints welded or joined by use of epoxy ought to have consistency to ensure that the joint is strong and firm. While the strength properties of the joints are important the fixed joints ought to have smooth finishes as opposed to angular projections which are not only hazardous but are as well less attractive where the aesthetics of the device is important. Several joining adhesives will be considered to form permanent fixed joints joining parts together as it is the case in joining the left and the right limb braces to the rest of the exoskeleton structure.

An aluminum epoxy tried in the first trial was weak unable to support any significant weight loaded to the exoskeleton ruling it out. Other options will be considered moving forward.

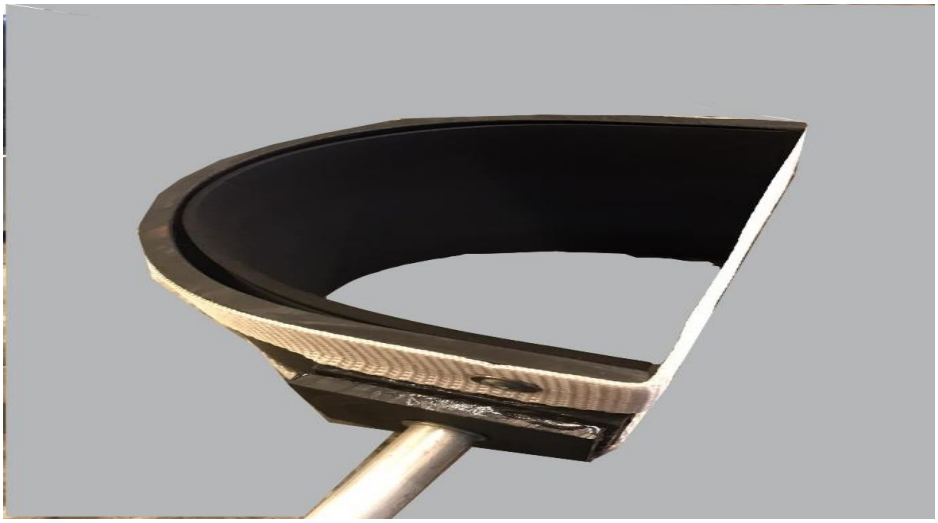

Figure 1: Limb brace fixed joint

On the scheduled tasks at this stage is progressive tests done regularly to see the suitability of actions and implementations done as highlighted below:

3. Design Tests:

Tests were carried out that were meant to verify the structural integrity of the overall structure. The tests conducted on the exoskeleton are non-destructive tests (NDT) performed on the device to check its strength and stability as well as other tests evaluating the capabilities of the device. Complete assembly of the motion triggering mechanical parts such as the axel and the transmission shafts is yet to be completed. Priority is given to testing the physical strength properties of the exoskeleton its maneuverability and the degrees of motion for both limbs. Other tests also important to the project to be completed include: initiation speed and the control speed the egonometrics of the device and its ease of use. The conducted test for the past duration period was that of the strength.

3.1. Strength on axial &lateral loads test:

The strength test is carried out to verify the capability of the exoskeleton to perform when loaded. Existence of lateral loads to the device can neither be ignored .Lateral loads may be arising from eccentric loads by the user due to a non-upright posture or generally a reaction force. A normal scale loaded to 5lbs force is used to test the strength under lateral loads which was done in a laboratory.

(The rest of the tests below are scheduled to be conducted with time consequently as the implementation continues).

3.2. Initiation and control speed test:

The pace at which the parts respond to commands by the user. This is dependent on the response time of sensors and generally the speed of the parts such as the motors and the gears. This is by design highly dependent on efficiencies which may be improved by elimination of friction among other energy losses. The weight of the individual parts is as well important as the overall input effort is directly affected.

3.3. Egonometrics and pose accuracy test:

The egonometrics of the device and the pose accuracy are basic primary design requirements which are verified through testing. The comfort the user gets while using the device is a requirement. This is pivotal in the determination of fatigue by the user. The alignment of the exoskeleton determines how it fits into the human body and hence determining the posture of the user.

3.4. Egress and ingress complexity test:

The test clarifies on complications in putting on and removing the exoskeleton. Flexibility of the exoskeleton is crucial and ought to have limited challenges. The test addresses challenges observed during the wearing of the exoskeleton.

3.5. Tests on degrees of movements:

The planes through which the limbs may move is important as defined by the possible angular extensions as designed. Certain predetermined loci paths are designed that see the various movements in a coordinated manner to achieve mobility. Such is achieved through alternate motion of the left and the right limb to see a forward motion .Collisions realized during testing are corrected to clear hindrances along the paths defined.

3.6. Tests on ease of maneuverability:

The manouvability of the exoskeleton is defined by the horizontal and vertical extensions achievable. The vertical manouvability of the device defines movement capabilities through different terrains vertical steps such as on staircases traversing inclined tramps and the speeds the device can achieve under all the circumstances.

The horizontal maneuver capabilities define flexibility on the x-y plane. Movements include backward and forward inclinations by the user and side to side torso movements. At this point joints and their capability to accommodate bending are tested.