Spec Sheet Needs

Wednesday, May 22, 2024 5:20 PM

For the ***Specification Sheet*** (spec sheet), we need to have the following data listed:

List of needs of the muscle:

- Force output range of the muscle by itself
  - The goal here is to not only understand how much force the muscles can produce but the accuracy of our control of that force. We want to be able to understand how our muscles functions so that we can test things accurately ourselves, create detailed muscle models and simulation, and provide the user with as much useful data as possible.
  - For this data group we want to record the minimum and maximum forces the muscle can produce and how accurate we can control that force. For this grouping of data we are not concerned with force quantized over some other variable like time but rather knowing how accurate we can get the forces to be under free and idealized scenarios. This data will be utilized for other metrics but we should end up with a chart of values containing the raw forces we were able to create and then the forces we generated vs the forces we tried to generate.
    - This data is needed so that the consumer understands what the implicit dangers or lack thereof are that are imposed by the device, due to the forces it can generate. Also the user needs this data to be able to make proper judgements on what type of tasks or use cases this device may have.
    - Force data will be needed for Delta so we can develop simulation and mathematical models as well as gauge the use cases of our product. This will in turn allow us to integrative nitinol muscle models into OpenSim and begin performing predictive simulation. Also in order to justify investment from potential investors we need to demonstrate our technologies use cases. Each of these important milestones is predicated upon our ability to get force data.
  - This type of data should include the specifications for the following use types:
    - The minimum and maximum amount of force in a linear actuation i.e. a straight pull
    - Any pre-made angled pulls created by us i.e. around an elbow/finger joint
    - Any common angled pulls that a large pool of consumers may want to use the muscle for i.e. pulleys, gears…etc.
    - Any common, non-proprietary, useful force equations should someone want to figure out a force given a certain scenario.
  - Forces should be in units of Newtons, Newton/Meters, lbs, ft/lbs,
  - Testing method should be as accurate and isolated as possible.
    - We need to test just the muscle to see the maximum potential force the nitinol spring can produce in its configuration for mk1 production
    - We need to test the muscle with the PCB and controllers attached to test the accuracy of our control scheme
    - Our testing method need to isolate as many variables as possible and at the vary lest accurately test a linear straight pull
    - We need to build a testing rig that accurately tests angled pulls for example around a pully
  - This data should be accompanied by graphs and videos:
    - Graphs should accompany all technical data and should be of the forces under certain variables i.e graph of ft/lbs of force over speed of contraction given a 6 inch linear pull.
    - Videos should be on the website and should show the situations that the graphs are based on i.e. a video showing the actuation that a graph is recording the values of.
- Force per displacement distance (i.e. our version of torque) produced by the muscle
  - Force per displacement distance is needed for both the consumer and Delta. This will give
- Speed of contraction of the muscle
- Accuracy of contraction of the muscle
- Control methods of the muscle
- Power requirements of the muscle
- Electrical specification of the muscle
- Operational temperature of the muscle
- Effective operational time of the muscle
- Biomechanical Specifications of the muscle
  - Isometric contraction specifications
  - Concentric contraction specifications
  - Eccentric contraction specifications
- Safety concerns of the muscle

List of variable needs for the PCB

Template for listing needed data:

- Needed data type
  - Give a general goal for the data
  - General summary of the data i.e what are we looking for
    - Why is it needed for the consumer
    - Why is it needed for Delta
  - Details on what specific data is needed and for what
  - Units of the data needs to be in
  - Testing method for the data
  - Summary of Internal vs externally released data
    - What should we consider for only internal release
    - What should we consider for an external (public) release
  - Any supplemental materials that need to be with this data

- Force per displacement distance (i.e. our version of torque) produced by the muscle
  - This data will help us to understand better the physical properties of nitinol and help use to develop an accurate mathematical model of how it functions. We want to be able to develop better actuators and also inform the user how best to set up the muscles to achieve certain goals.
  - For this data group we are looking for how the force changes, if at all, as the deformation of the material changes. We want to be looking an minimum and maximum forces produced at different amounts of deformation and we want to look at how different types of deformation effect this curve i.e. linear vs curved deformation.
    - This data is needed for the consumer as without this information

- Force data is needed for Safety
- Force data is needed to understand use case
- Force data is needed by both the consumer and Delta equally

- Force output range of the muscle by itself
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    - Force data will be needed for Delta so we can develop simulation and mathematical models as well as gauge the use cases of our product. This will in turn allow us to integrate nitinol muscle models into OpenSim and begin performing predictive simulation. Also in order to justify investment from potential investors we need to demonstrate our technologies use cases. Each of these important milestones is predicated upon our ability to get force data.
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  - Internal and external data for this data set will be different as we will most likely want to keep users within a safer or more reliable operational environment whilst internally we want to know and push our technology to certain limits
    - Internal values will be unedited except for removing the most extreme values that we deem to unfit for use.
    - External values will be trimmed to show the most important values so that data sheets are more legible and easy to follow. Also external values will have the minimum and maximum forces values "trimmed" so that users stay within safer and more reliable operational conditions
  - This data should be accompanied by graphs and videos:
    - Graphs should accompany all technical data and should be of the forces under certain variables i.e graph of ft/lbs of force over speed of contraction given a 6 inch linear pull.
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