Overview

This paper discusses an experimental approach towards characterizing a family of actuators produced by Festo. The authors explain their experiment, discuss the models they fit with, and provide results in the form of several surface plots.

What is missing is a holistic explanation of where this new data fits in the large number of existing works that look more generally at McKibben actuators. What makes Festo actuators different or better? Why do the other models not work? This is discussed, but only with papers that are 2-3 years old, not looking back more broadly.

The models selected are curve-fitting approaches rather than first principle models. This means that the physical meaning of the coefficients may not be apparent, and their portability to other designs may be less portable without a thoughtful analysis of the physical connection. Some discussion and rationale for the authors approach is expected.

Major Points

- The authors identify a number of papers that seek to characterize BPAs but fail to account for the wider family of papers that have done more comprehensive studies of McKibben Actuators. These actuators have been around a long time, and many people have characterized them. What then is the contribution here? Please answer a bit more broadly, considering that McKibben actuators is 70 year-old technology.
- Equation 1 includes a number of scalar coefficients whose origin are not explained fully. Please provide a summary of what each number is and how it is obtained; this is of course available in the other paper, but with paywalls these days it's best to include all the information necessary to understand your equations in the paper. You can be brief. But at the same time, it's important to know if these coefficients are general or specific for a certain set of conditions that is still valid here. Please explain.
- directly after Eq 1, you say the equation was updated, but don't say how or in what way.
- Please explain why you changed load cells. What are the differences in max load, and the resulting differences in noise, accuracy, and precision?
- Surface fit models are not based on first principles (pressure, stress, strain, geometry, etc), so do you have an understanding of how your results may be extrapolated to other actuator shapes or sizes?
- You might consider applying a model derived from a subset of your data and checking it against a smaller validation set of different actuators.

- Please discuss how or whether you believe your model is over-fitting. This seems like a possibility, given the number of coefficients your model obtains.
- the scaling laws associated with surface forces (friction) may not scale at the same rate as volumetrically-driven values; does your model account

for this?

Figures

- Figure 2A does a poor job at showing us the characteristics of the surface. Please consider overlaying a 2D grid over the surface shape so that we can see the warping of the 2D field caused by the 3D shape.
- The data points in figures 2a and 3 are small and their distance from the surface cannot be discerned. Please consider a different plotting strategy.
- The font size of your figures is too small compared to the body text's font size.
- The colors and shapes of your experimental setup labels should lend meaning to the figure. Without a table explaining the color and shape, they look arbitrary and distract from the figure itself.

Small Points

- 80/20 is a trade name. Please just say extruded aluminum frame and then in a footnote provide details and a link to the company.
- "to make the valve manifold opened or close the valve." –> "to make the valve manifold open or close the valve."

References

1. Schulte, H., 1961, "The Characteristics of the McKibben Artificial Muscles," The Application of External Power in Prosthetics and Orthotics, National Academy of Sciences-National Research Council, Washington, DC, pp. 94–115.
2. Kothera, C. S., Jangid, M., Sirohi, J., and Wereley, N. M. (August 19, 2009). "Experimental Characterization and Static Modeling of McKibben Actuators." ASME. J. Mech. Des. September 2009; 131(9): 091010. https://doi.org/10.1115/1.3158982
3. Tondu, Bertrand. "Modelling of the McKibben artificial muscle: A review." Journal of Intelligent Material Systems and Structures 23.3 (2012): 225-253.