I would rank this paper as a four out of five. I believe that it successfully demonstrates the potential qualitative benefits from using a fluid actuation but does not show a major performance increase quantitatively. The idea of using pneumatics or hydraulics as a method of monitoring your applied force is very intuitive since the output force is measured directly by the input. However, it seems as though it could struggle to compete with the more developed, existing methodologies. This paper could be improved if it included some metrics that showed relative value of fluid actuation or a demonstration of the other methodologies attempting the same task for comparison.

The primary contribution of this paper is the use of fluid actuation as a methodology for force feedback in a system. Previous methodologies included serial elastic actuation and static actuation with endpoint sensors. The novelty of fluid actuation is that it removes the constraints of the other control types. There is no need to have your actuator and joint be in close proximity to each other, there is no need to have an external force sensor, and you no longer have to model the properties of a soft actuator. These benefits are exchanged for a slower bandwidth as changing pressure cannot adapt as rapidly. While the ideas of pneumatic and hydraulic actuation are not new necessarily, this paper highlights a specific usage and provides the in-depth models for fluid actuation as used for gripping.

The paper succeeds in classifying and modeling the system dynamics with both theoretical and practical measurements. If someone wanted to use the proposed methodology, then this paper is an excellent and in-depth reference for how to control the system as well as the characteristics it would exhibit. It includes additional controller elements to counteract elements like friction and includes references to what elements you need to minimize for the best results. For someone looking to implement this work there is almost nothing that you would have to discover for yourself. Additionally, the paper also includes significant analysis of potential scenarios that would benefit from seeing a compliant gripping mechanism such as picking up delicate objects or being safe around humans. The inclusion of potential areas for use makes it easier to keep track of the main ideas of the paper.

Where the paper falls is in its comparisons to other state-of-the-art techniques (or lack thereof). While I think the paper does demonstrate the usefulness of the technique it developed, I would still like to see some relative measurements. Whether just as a method of providing some context to the potential of soft actuation or to show areas of particular success, having a clear numerical comparison between the existing techniques and the paper’s approach would help better clarify its place in the field.

The paper seems like a great foundation for creating humanoid or bio-inspired grasping and actuation. Almost all muscles have some sense of force feedback that makes us able to exhibit both tremendous strength and precise dexterity. In order to move towards more accurate hand prosthetics, humanoid robots, and just overall more precise robotics actuation having internal force feedback will be a necessity. In terms of potential applications, having internal force feedback could make applications like opening twist lids, carrying fragile objects, and turning door handles a possibility for robotic systems. In particular this paper seems like it could be useful to implement with a project like the haptic feedback glove that is being worked on here at WPI as it could be used both as the haptic feedback and the robotic actuation.