**Meta review:**

Paper Contribution: The paper introduces a fully-actuated drone with rotating arms, enabling it to hover in various orientations, facilitated by a sequential quadratic programming (SQP) approach. The authors offer thorough justifications for the proposed design and provide insights into the performance of the fully-actuated drone.

Pros: As implied by its name, this drone boasts full actuation, allowing active arm rotation to adjust flight posture, thereby enhancing maneuverability in multiple directions while maintaining a simple form.

Cons: The added actuation mechanisms may contribute to increased weight and reduced aerodynamic efficiency. Overall, the paper appears to build upon the authors' prior work in drone innovation, particularly in introducing the slip ring concept. However, concerns arise regarding the optimization process's computational demands and the potential for swift and stable convergence. While the proposed drone demonstrates functionality, its comparative advantage over previous iterations remains unclear. Reviewers also offer constructive feedback on idea conceptualization, modeling, and presentation, suggesting thorough works for future manuscript versions.

Some notes:

* Term "SQP" in the title may be confused for many readers at the first look.
* A series of citations should not be included with certain justification, like [4-6, 8-10...] in page 1
* How to get metrics in Fig. 2? More details should be added.
* More details on the thrust force measurement setup.
* In section IV, should we have the model for describing MOMAV's dynamics
* In the paragraph under the Algorithm 1, the authors mentioned about "intuitively tuned". More details should be added

\*Video cannot be opened properly in this AE’s computer

**Overall Recommendation:** Reject

**Review JWf3:**

**Summary Of Contribution:**

This paper introduces a MOMAV, a symmetrical fully-actuated multirotor drone that gains low mean position/orientation error when sweeping position and orientation setpoints. A novel six rotational arm multi-copter design, optimizing configuration method, and a novel control allocation SQP-based algorithm have been proposed.

**Summary Of Strengths:**

(1) The drone arm design is novel, simple but elegant. This approach can be applied to multicopers or other rotational end-effectors.  
(2) This opens a room for developing adaptive configurations of multicopters in complex environments and tasks.  
(3) The simulation for drone configuration is sounds and makes sense.  
(4) The rotation and translation of drone is elegant.  
(5) The paper structure is quite clear and easy to read.

**Summary Of Limitations:**

(1) The theoretical basis for simulation in section II and the selection of experimental parameters in section III.B has not been clarified.  
(2) The experiment for slip ring losses is not clearly described.  
(3) It lacks important demonstrations to prove the advantages of having six active actuators.  
(4) Additionally, the performance of having slip rings to prevent wire winding does not show.

**Feedback For Improvement Or Clarification:**

While most concerned issues are aforementioned in the previous part, a few more shortcomings also need to be addressed as below:   
(1) Why were 5 configurations chosen for simulation? Could we simulate with other proposed symmetrical configurations?  
(2) Do the outer disturbance and power losses need to be considered as input in the control allocation? Could you clarify this statement?  
(3) More important demonstrations are needed as mentioned in previous part (4) Why two locations were chosen for the test (Fig 6.C and D);  
(5) “Arm actuator is slowly spin”: How and why is slowly spin?  
(6) Please clarify how to calculate the slip-ring losses.

**Nature Of Contribution:**

It is a System paper.

**Overall Recommendation:** Weak Reject

**Review 4sFq:**

**Summary Of Contribution:**

The authors proposed a novel design of variable-tilt drone (MOMAV) with six propellers and six arm-angle servors. Such design is to increase flight efficiency independently of its current orientation. Furthermore, arm assemblies have the capability to be controlled at an arbitrary angle to allow for a variety of revolutions, while simultaneously supplying power to the propeller motors.

**Summary Of Strengths:**

* The authors presented the design (The overall design of the frame as well as the detail design and working principle of the rotating arm are included) and evaluation of each variant's flight capabilities in a detailed and logical manner.
* The authors proposed the group of optimization functions for the important control parameters. “The objective function O is chosen with the intention of minimizing power consumption, while keeping the solution (u∗, a∗) feasible. It is split up in four goals, each one weighted against the others: • Minimize the squared sum of throttles • Minimize the squared rotation velocity of the arms • Constrain the throttles within 0-100% • Constrain the arm rotation velocities within ±2rev/sec”

**Summary Of Limitations:**

The system had no mathematical modeling that could be used to evaluate physical factors such as thrust force, drag force, and develop other logical variations of the physical model.

**Feedback For Improvement Or Clarification:**

* Authors should clearly indicate the contributions of this research in Section I .
* The authors indicated the thrust of the MOAV is 6.4 kg. How to determine this value? If it is the measurement data, the authors should describe the experiment in detail.
* Due to its structural novelty, the MOAV needs to be compared in basic characteristics (such as flight time, flight velocity, control strategy) with similar ones (similar body weight, similar size). Potential application of such kind of drone also should be discussed in this manuscript.
* How does the MOAV react to wind load?

**Nature Of Contribution:**

This research contributes to the RSS conference in accordance with its criteria.

**Overall Recommendation:** Accept

**Review WZEs:**

**Summary Of Contribution:**

This paper presents a fully actuated multirotor based on a highly symmetric octahedron design. Each arm is equipped with a servo, allowing it to continuously rotate about its principle axes without joint limits. With the proposed method for thrust allocation, taking into consideration the rotational rates of those arms, fully actuated flights were demonstrated.

**Summary Of Strengths:**

Overall, the manuscript is easy to follow, well structured, and adequately illustrated (figure-wise). According to my understanding, the performance of the robot seems satisfactory. The robot has an ability to perform basic maneuvers in 6 DoFs as intended.

**Summary Of Limitations:**

However, I have some reservations on the contribution of the work, partially due to the limited results (which could be more comprehensive) and how the manuscript is written. Please find detailed comments below.

**Feedback For Improvement Or Clarification:**

* Intro: ".. accelerate forward without having to lean forward, or lean forward without having to accelerate." - This sentence is awkward. I wouldnt say a multirotor "leans" forward.
* Literature review and motivation: I understand the objectives of the work and what the authors claim to be the motivation. According to the authors, they are (i) the superior hovering efficiency of the octahedron configuration; and (ii) the rotor arm design with slip rings for continuous rotation without joint limits. However, the literature review is brief and it doesn't state the motivation. It does not say explicitly shortcomings of previous robots. The manuscript only states that there are fixed-tilt designs and variable tilt desigs for fully actuated multicopters.
* I'm not sure I fully understand the definition of X\_2. Isn't that number hardware dependent? For example, a regular quadcopter with X\_2 = 0.5 means it has a thrust-to-weight ratio of two. This is not specific to the design. In such cases, how can you make a comparison?
* It would be useful to add some explanation why the resistance in Fig. 6 A (and B) is not constant. Could it just be the uncertainty of measurements at low current? Can we also see the plot of V vs I directly? (For 6B, P vs I^2 might be useful too). In addition, since in flight, the current will be large (close to 10 A or higher), should we just focus on those high current cases and assume the resistance is constant? (This suggestion may be valid or invalid, but I think it it would be clearer to see from a V-vs-I plot).
* In addition, how large is 0.2 Ohm in comparison to regular cases?
* S.III.B: after the sentence "The results are presented as box plots (Fig. 6A, 6B)", please provide a conclusion. What do you want us to see?
* S.III.B: mayor >> major
* S.IV: There is no need to emphasize that your PID controller is "very basic".
* S.IV: Please clarify that when you mention other algorithms based on pseudo-inverse, would this be applicable to your robot? As you only state that it will not sufffer from the same issue. If there are no drawbacks, why not use that?
* S.V: "Testflights" >> Test Flights.
* S.V: "... For example, the orientation-sweep steps are: [ ... ]". That notation in the square brackets makes no sense at all.
* While the results demonstrate that the robot works as intended, it does not really show how well it works. For example, you did not explictly compare this control allocation method with other methods and highlight where other methods fall short and yours do better. This doesnt really validate the contribution of the work.

**Nature Of Contribution:**

It is not clear what problems the robot solves or what improvements are made compared to existing platforms. The authors have made some claims but did not experimentally validate them.

**Overall Recommendation:** Reject

**Changes:**

* fixed long citation in section II
* added equations for efficiency X1,X2 analysis
* added text section with explanation for above & some more discussion
* added more arm configurations
* (additional label on fig 4)

**Todo:**

* Experiment slipring losses vs thrust, power, efficiency, etc.
  + No slipring, slipring on batter, slipring on motor
  + Force, torque, current, power, efficiency, “loss %”
  + Temperature at full throttle?
  + Recalculate thrust (max. Upwards)
* Redo supplementary materials (more/newer videos)
* REREAD EVERYTHING CAREFULLY!
* spellcheck