The proposed paper focuses on controlling quadruped robot orientation during the flight phase of a leap, that is when the gravity is the only external forces exerted on the system. Because of the conservation of the total angular momentum, it is possible to steer the robot orientation changing its inertia, i.e. rearranging the position of the bodies of which it is composed. Most of the quadruped robots have lightweight legs, leading to reduced control authority on the orientation. In [Kurtz et al., 2021] special heavy boots are proposed for increasing legs inertia, nevertheless this solution complicates the locomotion that cannot anymore rely on the massless leg assumption. Taking inspiration form quadrupedal animals, works like [Chu et al., 2019] proposes the introduction of another link, the tail, to control the orientation, that can accounts only for a single jump because of its range of motion [Johnson et al., 2012]. Flywheels represent an additional option. This device has been sporadically investigated in legged locomotion for controlling only the pitch orientation, both for bipeds and quadrupeds, as in [Brown et al., 2016] and [Kolvenbach et al., 2019].
We present an Orientation Control System based on two flywheels, mounted on the trunk of the quadruped Solo12. Their axes of rotation are designed to be incident for controlling both roll and pitch angles, considering the different moment of inertia in the two directions. We tested the concept with simulations.

We confirm that neither the manuscript nor any parts of its content are currently under consideration or published in another journal.
All authors have approved the manuscript and agree with the submission to MDPI Sensors.