

# Development of a Compact and Easily Packageable Serpentine Robotic Tail System

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**Abstract:** This work covers the design, fabrication, and initial testing of a reduced size serpentine robotic tail system. Previously the Robotics and Mechatronics Laboratory had designed and produced a working prototype of a serpentine robotic tail known as the Roll Revolute Revolute Robotic Tail (R3RT). With this prototype the lab was able to verify the quality of the design and modelling of the tail; however, due to the size of the prototype integrating it with a legged robotic base was made difficult. In order to facilitate research efforts around the addition of a tail to a reduced degree of freedom (DOF) quadruped robot, a reduced size version of the R3RT tail was required. The design of the reduced size tail started with simulation to determine necessary dimensions and power requirement to the tail in order to achieve in air reorientation of an existing 4 DOF quadruped base. Based on these simulation results it was seen that the development of a new, more compact and power dense, actuator was necessary. The design of this actuator and the changes it allowed to be made to the original R3RT's layout were instrumental in reducing the mass and packaging envelope of the tail, thereby allowing it to be integrated with the existing quadruped's design. Thus, this work covers the simulation methods and results before taking a detailed look at the actuator design and tested performance. This work concludes with an overview of the tail system design in its entirety, the integration of the tail with the quadruped base, and initial results from experiments with the complete tail and base robot.

**Acknowledgement:** This material is partially based upon work supported by the National Science Foundation under Grant No. 1906727