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CONTROL SYSTEM DESIGN FOR A MORPHING WING TRAILING EDGE

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Summary: Shape control of adaptive wings has the potential to enhance wing aerodynamic performance during cruise and high-speed off-design conditions. A possible way to attain this objective is to develop specific technologies for trailing edge morphing, aimed at variating the airfoil camber. In the
framework of SARISTU project (EU-FP7), an innovative structural system incorporating a gapless deformable trailing edge has been developed. A related key technology is the capability to emulate and maintain pre-selected target wing shapes within an established margin, enabling optimal aerodynamic performance under current operational pressure loads.

In this paper, the design of a control system aimed at preserving the specific geometry envelope under variable conditions, is numerically and experimentally explored. The actuation concept relies on a quick-return mechanism, driven by load-bearing actuators that act on morphing ribs, directly and individually. The adopted unshafted distributed electromechanical system arrangement uses servo-rotary actuators each rated for the torque of a single adaptive rib of the morphing structure. The adopted layout ensures compactness and weight limitations, essential to produce a clean aerodynamic system. A FBG-based distributed sensor system generates the information for appropriate open- and closed-loop control actions and, at the same time, monitors possible failures in the actuation mechanism.