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Biologically-inspired approach for aircraft management under upset conditions

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In this presentation, two biologically-inspired approaches are presented and integrated to address the problem of detection and identification of aircraft sub-system failures. Firstly, a cluster set union-based algorithm is used for anomaly detection and it is inspired on an immunity process to generate antibodies known as negative selection. Then, a structured non-self approach developed through an empirical selection of sub-selves and the application of an immune positive selection-type mechanism is utilized to capture the dynamic fingerprints of particular upset conditions by classification and quantification of the anomaly condition. Within this analysis, actuator, engine, structural and sensor failures are considered at different magnitudes. Experimental data obtained from a motion-based six-degrees-of-freedom flight simulator is used to generate 2-dimensional Self/Non-Self projections and to evaluate the performance of the algorithm in terms of percentage detection and identification rates, and false alarms. The immunity-based health management approach integrates a direct evaluation stage in which the affected sub-system, type of failure and magnitude are correctly identified.

Biography

Hever Moncayo is an Assistant Professor in the Department of Aerospace Engineering at Embry-Riddle Aeronautical University. He earned a PhD in Aerospace Engineering from West Virginia University. As a researcher, he has devoted his efforts in different activities to perform R&D focused on the development of algorithms for guidance, navigation and control, including simulation of comprehensive/integrated methodologies for intelligent/adaptive fault tolerant flight control systems.

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