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Developing a virtual stiffness-damping system for airfoil aeroelasticity testing

Proceedings of the 20th IEEE International Conference on Industrial Technology (ICIT 2019), 2019 / vol.2019-February, pp.96-101

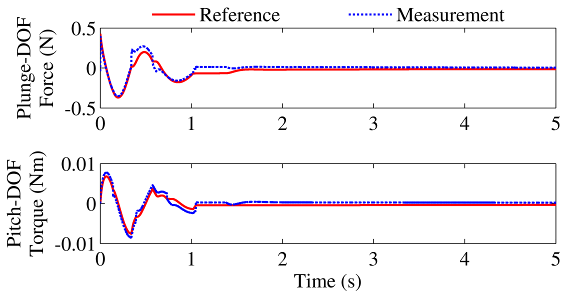

Fig. 10. VSDS force/torque under LQG control in Case 1 tests.

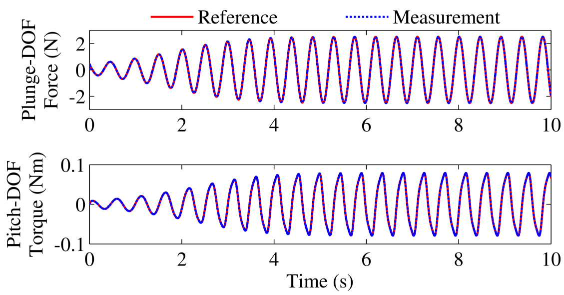

Fig. 11. VSDS force/torque under UIE-LQG control in Case 1 tests.

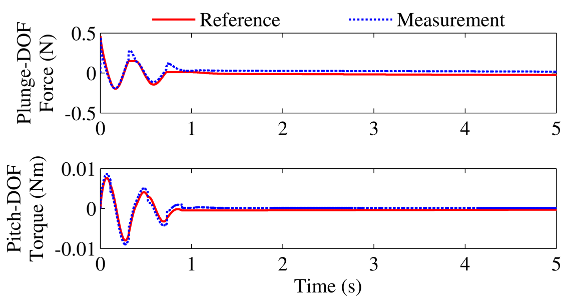

Fig. 12. VSDS force/torque under LQG control in Case 2 tests.

Fig. 13. VSDS force/torque under UIE-LQG control in Case 2 tests.

operation principle proposed effectively addresses dynamics coupling between each DOF without the need for sophisticated aeroelastic modeling. Resolution loss in velocity measurement is identi ed as a main problem associated with the rst trial of non-reduction transmission on a VSDS and is solved by the proposed MESO. The proposed VSDS control system with UIE-LQG control enables robust force/torque tracking and signi cantly reduces system identi cation and calibration procedures in VSDS development, although with some phase lag introduced. Wind-tunnel experiments con rms that the new 2-DOF VSDS prototype can provide satisfactory simulation of structural stiffness and damping for AAT. Future work will focus on further reduction of the phase lag introduced by the control system.

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