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An Adaptive Controller Method Based on Full-State Linear Model of Variable Cycle Engine

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Abstract : Due to the more variable geometry parameters of VCE (variable cycle aircraft engine), presents an adaptive controller method based on the full-state linear model of VCE and has simulated to solve the multivariate controller design problem of the whole flight envelops. First, analyzes the static and dynamic performances of bypass ratio and other state parameters caused by variable geometric components, and develops nonlinear component model of VCE. Then based on the component model, through small deviation linearization of main fuel (Wf), the area of tail nozzle throat (A8) and the angle of rear bypass ejector (A163), setting up multiple linear model which variable geometric parameters can be inputs. Second, designs the adaptive controllers for VCE linear models of different nominal points. Among them, considering of modeling uncertainties and external disturbances, derives the adaptive law by lyapunov function. The simulation results showed that, the adaptive controller method based on full-state linear model used the angle of rear bypass ejector as input and effectively solved the multivariate control problems of VCE. The performance of all nominal points could track the desired closed-loop reference instructions. The adjust time was less than 1.2s, and the system overshoot was less than 1%, at the same time, the errors of steady states were less than 0.5% and the dynamic tracking errors were less than 1%. In addition, the designed controller could effectively suppress interference and reached the desired commands with different external random noise signals.

Keywords : variable cycle engine (VCE), full-state linear model, adaptive control, by-pass ratio
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