A Reduced-Order-Model-Based Multiple-in Multiple-out Gust Alleviation

Control Law Design for Transonic Aeroelastic wings

Chen Gang , Wang Xian, Li Yueming

State Key Laboratory for Strength and Vibration of Mechanical Structures, School of Aerospace, Xi'an Jiaotong University, Xi'an, Shaanxi, China, 710049

*Corresponding author: aachengang@mail.xjtu.edu.cn

Gust alleviation is very important to a large flexible aircraft. In transonic flow, a nonlinear low-order aerodynamic state space model is required to model the nonlinear aeroelastic responses duo to gust. A reduced order modeling of gust loads was proposed which bases on the proper orthogonal decomposition method. And then the open-loop and closed-loop reduced order state space model for the transonic aeroelastic system was developed. The static output feedback control scheme was used to design a simple multiple-in multiple-out gust alleviation control law. The control law was demonstrated with the Goland+ wing model with four control surfaces. The simulation results of different discrete gusts show the capability and good performance of the MIMO controller in transonic gust alleviation.

Key words :transonic gust alleviation, reduced order model, proper orthogonal decomposition, static output feed back