CS333

AMMCS 2022

应用数学，建模与计算机仿真国际学术会议

Applied Mathematics, Modeling and Computer Simulation

August 13-14, 2022
Wuhan, China

Simulation Research on Helicopter Airframe Vibration Reduction Based on Intelligent Control

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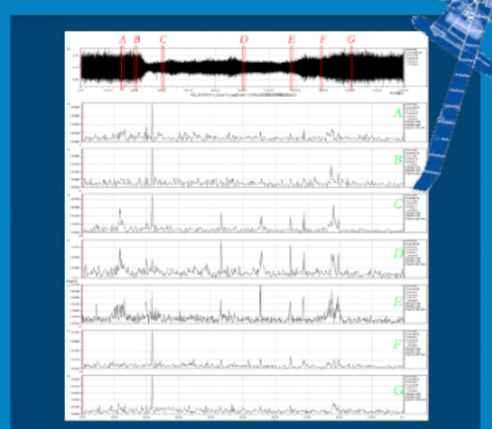
INTRODUCTION

Aiming at the requirements of helicopter time-domain vibration control, this paper starts from the vibration active control device of a certain type of aircraft, and adopts the method based on fuzzy control and neural network theory to build the logical relationship between controller output and controller input. Based on SIMULINK emulation module, the mathematical model of helicopter active vibration control has been built. The theoretical control effect of the proposed control model is verified by using the helicopter vibration test data under typical flight conditions as input.

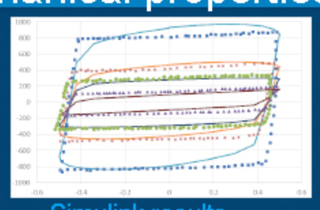


Helicopter vibration

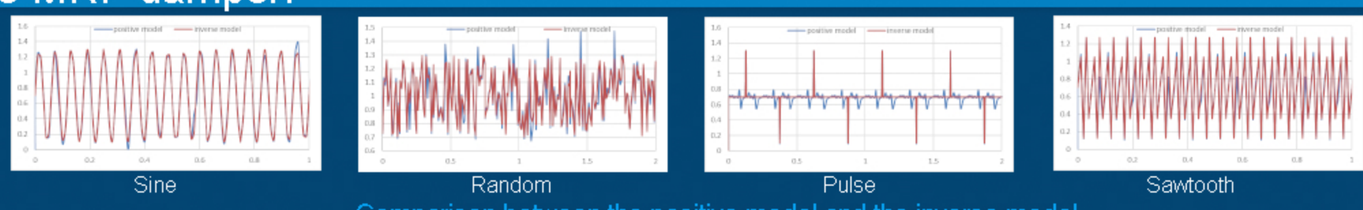
MODELING

This paper adopts the MRF shock absorber for damper. The parameterized dynamic Bingham model is used to simulate the motion relationship. It shows that the hyperbolic tangent model can better describe the mechanical properties of the MRF damper.

The inverse model of the MRF damper is to obtain the control current of the damper according to the displacement, velocity, acceleration and expected damping force of the damper. The relationship between damping force and current.



Simulink results



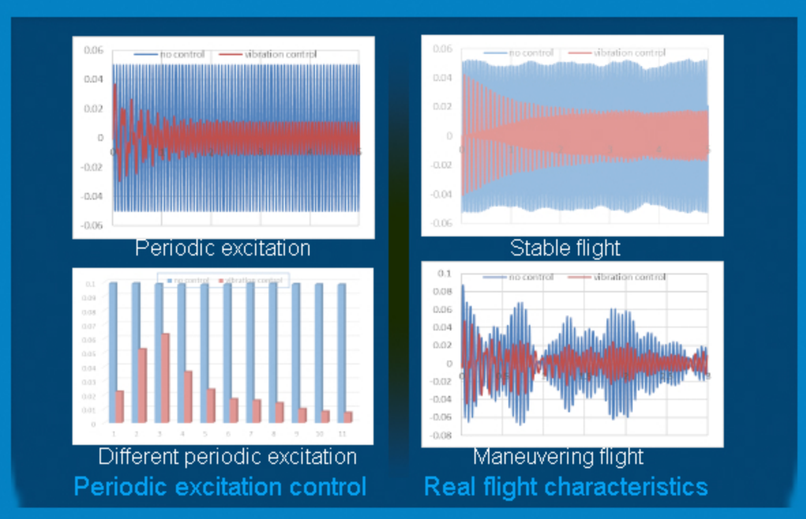
Sine　Random　Pulse　Sawtooth

Comparison between the positive model and the inverse model

CONCLUSIONS

The control system was simulated by periodic excitation and measured helicopter flight excitation respectively. The results of this study showed that:

- The model is established and validated with the test date.
- It has a good control effect on fixed frequency, achieving 80% reduce.
- The vibration control rate is about 72.8% in stable flight, and reduced to 50%-65% in maneuvering flight.



Periodic excitation　Stable flight

Different periodic excitation　Maneuvering flight

Periodic excitation control　Real flight characteristics

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