On the active vibration control of a flat plate with a self-made PVDF actuator

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【Summary】

◆ Effect of active vibration control by means of a self-made actuator made of polyvinylidene difluoride (PVDF) was experimentally investigated
◆ Actuator was composed of two acrylic films, two film electrodes, and PVDF
◆ PVDF was installed between two acrylic films, and film electrodes were glued onto both sides of PVDF
◆ Results of the active vibration control showed that the vibrational acceleration of a flat plate in the range from 2 m/s^2 to 12 m/s^2 could be decreased up to 50 % by the actuator in the vibration control of one point and one frequency and up to 40 % in the case of one point and two frequencies
◆ Our self-made PVDF actuator is a simple and lightweight structure that has a possibility to be effectively used in the active vibration control

【Background】

■ As represented by a sharp shift towards the development of electric vehicles in the automobile industry, electric machinery products are becoming more electrified, smaller, and lighter, and with this, machines produce high vibration frequencies
■ Conventional control theory and control actuator will lack the active control technique and effect on vibration noise in the near future
■ Against this backdrop, we conducted elemental research towards realization of a lightweight, low-power consumption and low-cost vibration and noise control actuator that enables high-frequency and wideband vibration and noise control
■ We studied the vibration damping possibility of a vibrating body using PVDF as a material of actuator

【Experimental】

● PVDF actuator

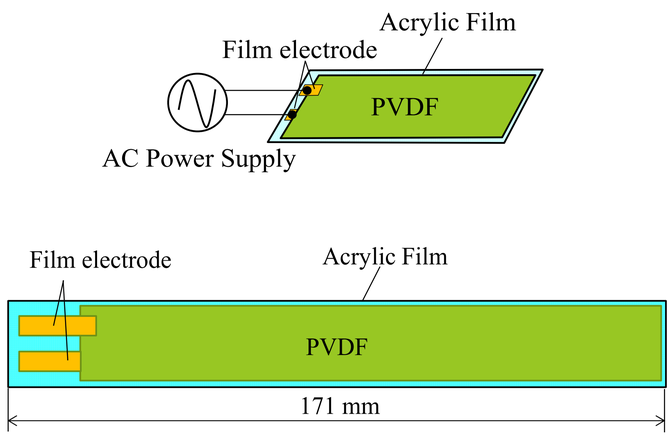

Fig. 1 Perspective and top view of the PVDF actuator

● Experimental setup

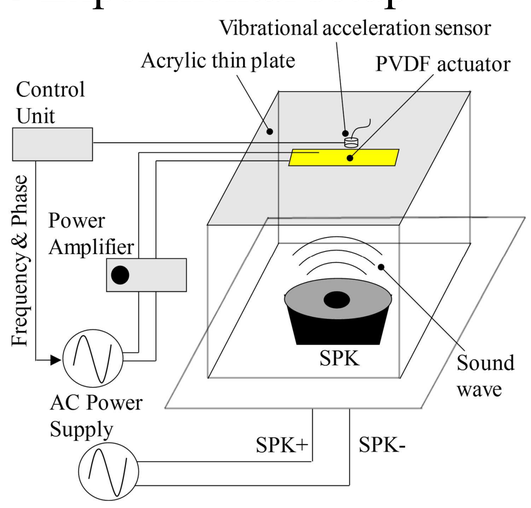

Fig. 2 Schematic view of the experimental setup

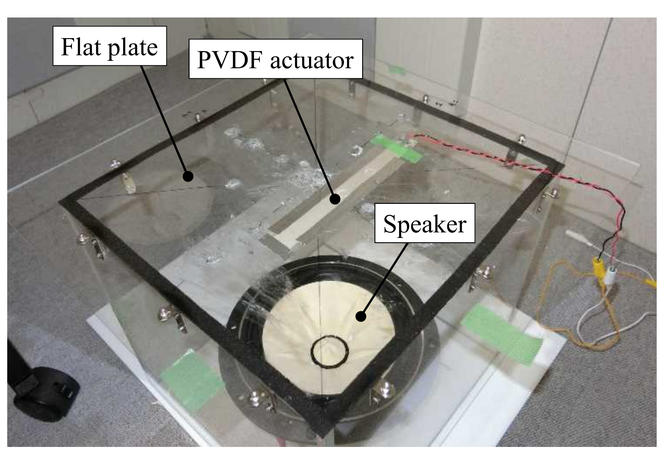

Fig. 3 Photograph of the experimental setup

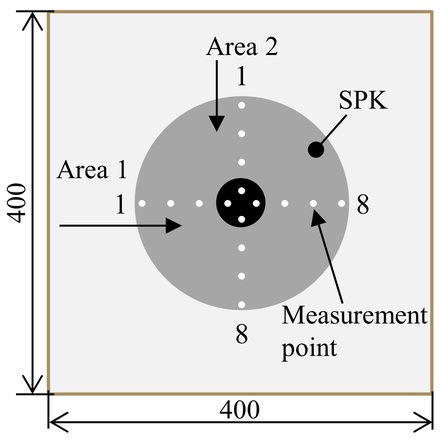

Fig. 4 Measurement points of the vibrational acceleration of the flat plate

【Results】

Control of single frequency vibration

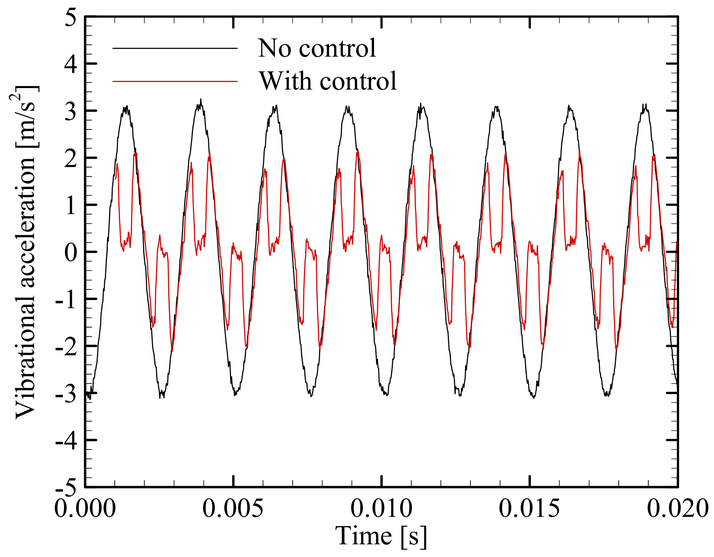

Fig. 5 Time series of the vibrational acceleration at the center of the plate (400 Hz)

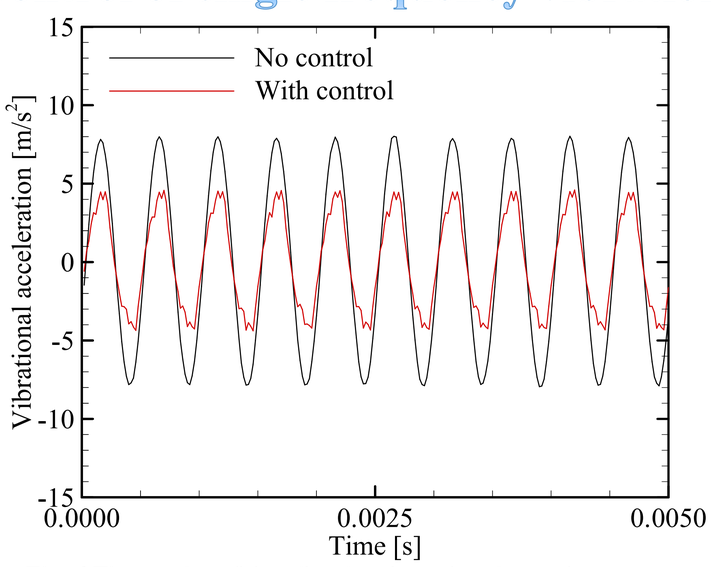

Fig. 6 Time series of the vibrational acceleration at the center of the plate (2,000 Hz)

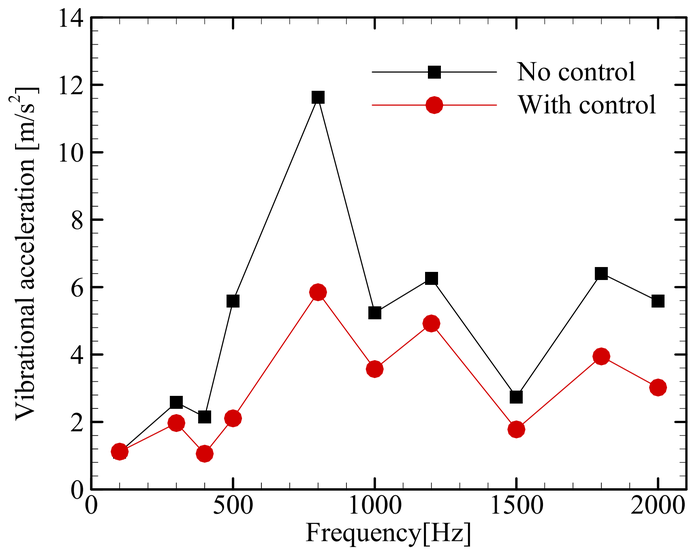

Fig. 7 Effect of the active vibration control at the center of the plate

Control of dual frequency vibration

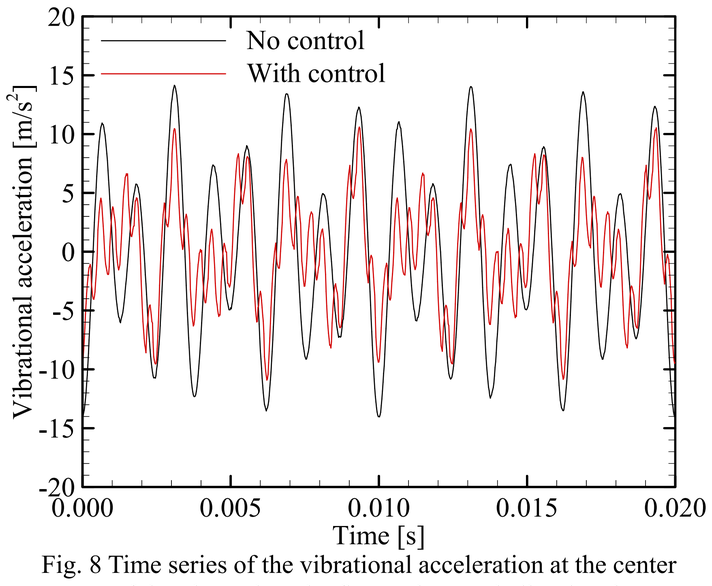

Fig. 8 Time series of the vibrational acceleration at the center of the plate when the first and second vibrational frequencies were 500 Hz and 800 Hz, respectively

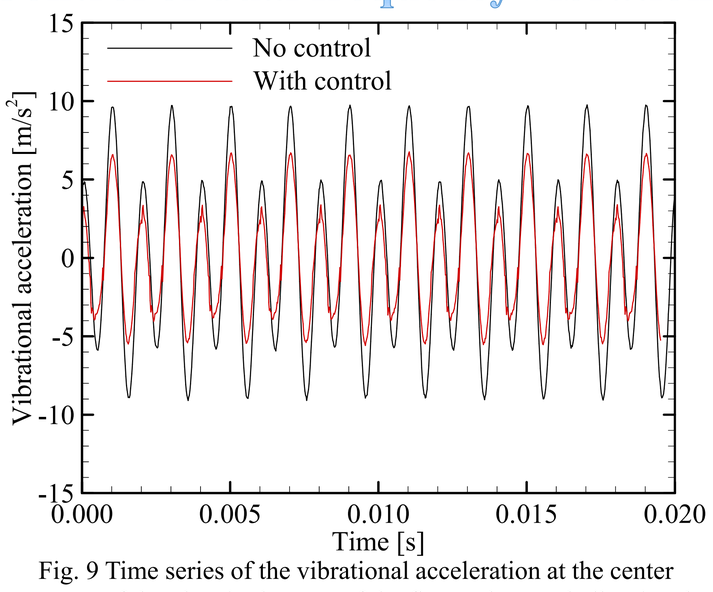

Fig. 9 Time series of the vibrational acceleration at the center of the plate in the case of the first and second vibrational frequencies of 500 Hz and 1,000 Hz, respectively

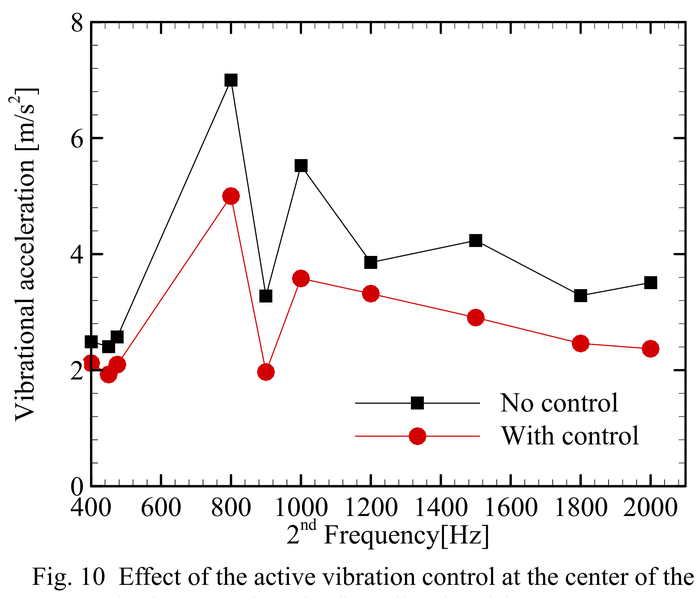

Fig. 10 Effect of the active vibration control at the center of the plate in the case when the first vibrational frequency was 500 Hz

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