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Study of a liquid droplet ejection device using multi-actuator
マルチアクチュエータによる液滴噴射素子の圧力制御の検討

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1. Introduction

The technology of an inkjet printer is expected to be used in digital printing and in printing to various kinds of materials. Consequently, fast and stable ink-ejection technology is required to meet the diversified needs. Amemiya et. al. succeeded in discharging the ink whose viscosity was 3000 mPa・s using a focused ultrasound wave This report suggests that the amount of pressure and the time to apply pressure to ink are the most important factor for discharging the ink with high viscosity. Ono et.al. studied a Kaiser-type inkjet printer using multi-piezoelectric elements to control the pressure and the time to apply pressure to the pressure chamber. They proposed an equivalent circuit model and simulated to find effectiveness of using a multi-actuator.

The conventional droplet discharge was performed by applying a momentarily higher pressure using a piezoelectric element.

In this study, we focused on the generation process of pressure in the pressure chamber and the possibility of generating an ink droplet by experimentally making a liquid droplet ejection device using multiple actuators.

2. Results and discussion

Figure 1 shows the structure of a liquid droplet ejection device. Three multiple piezoelectric elements are attached to the pressure chamber. Amount of pressure and time to apply pressure to the pressure chamber are controlled by the driving voltage applied to the three multiple piezoelectric elements. Sinusoidal or square waves are input to the three piezoelectric elements. The changes in pressure are measured by changing the number of drive elements. In this case, the ink supply port and the nozzle are closed. Figure 2 shows the results of inputting a sine -wave signal with the same phase. Figure2 (a) is an output signal of driving one piezoelectric element and Figure2 (b) shows an output signal of driving three piezoelectric elements. Figure 3 (a) and (b) show the measurement results of inputting a square wave to a single piezoelectric element (a) and three piezoelectric elements (b). The output signal number increases with increasing the driving piezoelectric element. From the result, it is possible to control the pressure.

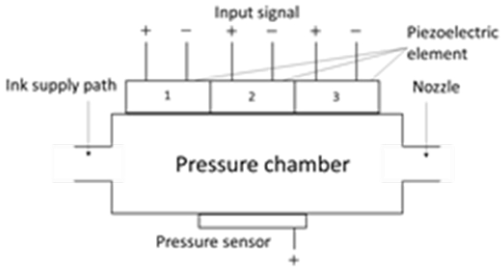

Fig.1 Model structure of the liquid droplet ejection device.

3. Conclusion

An output signal can be proportionally controlled by the number of driving piezoelectric elements using a prototype liquid droplet ejecting device. Furthermore, by controlling the phase of the drive signal, it is expected that the amount of time to apply pressure can be controlled. pressure applied to the pressure chamber and the

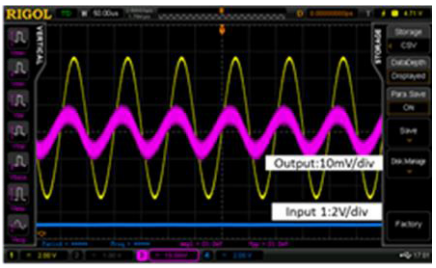

Fig2(a)

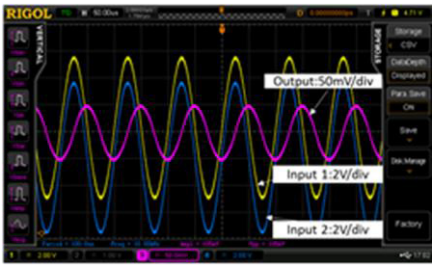

Fig2(b)

Fig.2 Output waveforms in the case of applying a sine wave with the same phase. The number of element is one (a) and three (b)

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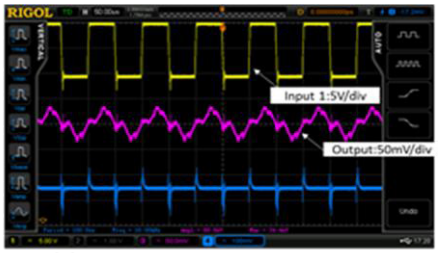

Fig3(a)

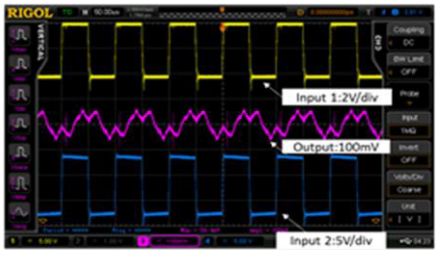

Fig3(b)

Fig.3 Output waveforms in the case of applying a square wave with the same phase. The number of element is one (a) and three (b)

Reference

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2. Y. Ono et.al, Jpn. "J. Appl. Phys. 5507KD10 doi:10.7567/JJAP.55.07KD10"