$$U_i \uparrow \rightarrow U_d \uparrow \rightarrow U_o \uparrow \rightarrow U_e \downarrow \rightarrow U_f \uparrow \rightarrow (V_{CC} - V_{SS}) \downarrow \rightarrow U_d \downarrow$$

IV. THE RESULTS AND ITS ANALYSIS

We designed an excitation signal source and used it in the application of thickness measurement for PCB copper foil. Its frequency is 307 KHz. The tests on U_r 、 U_o and V_{ref} were performed with temperature range from 0℃ to +70℃.

Figure 8 is the actual U_r wave when the temperature is 25℃. U_r =1.05V， U_o =0.4767V，and V_{ref} =-2.485V。

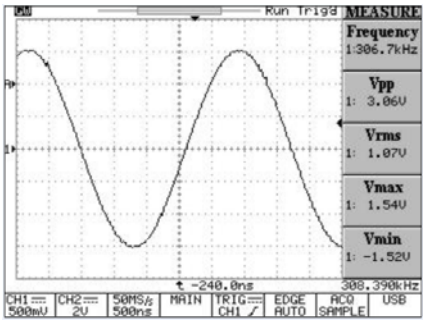

Figure. 8 Waveform of Ur

Under the condition of V+=5V 、 V-=-5V, the measurements on U_r 、 U_o and V_{ref} were performed at each of following temperature points: 0℃,25℃,50℃,and 70℃, and the temperature was kept at each specific point for 30 minutes. The table one shows the results:

TABLE. 1 TEST DATA

T（℃）	Ur (V)	Uo (V)	Vref (V)
0	1.05	0.4766	-2.486
25	1.05	0.4767	-2.485
50	1.05	0.4768	-2.483
70	1.05	0.4770	-2.482

From above table, it shows that U_r does not change when the temperature changes from 0℃ to +70℃； since the output DC voltage $\Delta U_o = 0.4mV$ ， from equation (6)， ΔU_o is caused by $\Delta V_{ref} = 4mV$ ， this would ensure a stable excitation signal U_r and a stable and accurate U_o as a base voltage for A/D conversion。

V. CONCLUSION

In this paper, an excitation signal source with effective temperature-drifting suppression is designed for eddy current testing. The temperature drifting problem in op-amps is studied as well. The mathematical model is established for a improvement of the negative feedback system. Based on the analysis of the mathematical model, the system and its circuits are designed with lock-in amplifier and integrating circuit as the core parts of the system for temperature-drifting suppression. The test results indicate that this approach and its design is very effective in suppressing temperature drifting. The excitation signal and output reference voltages are very stable. This ensures a consistent and accurate thickness measurement results for PCB copper foil.

We believe that the study and design of an improved excitation signal source in this paper can be applied in other applications as well.

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