CHAPTER VI

CONCLUSION

In order to obtain plasma parameters in defining properties of any plasma process, the use of a single electrical probe is one of the techniques to realize those parameters. The technique relies on the electrical property of plasma by inserting a small metallic tip, to which a voltage source supplies, into plasma and measuring current flowing through it as a function of voltage. With this measurement, current-voltage data are acquired. In this work, we used a bipolar voltage source and pA meter (HP 4140B) fully controlled by LabVIEW environment to record the feedback I-V data. The program was designed to adjust voltage-sweeping length in minimizing the discrepancy between upper-sweep and lower-sweep turn of current measurement. The adjustable length helped the program acquire more information in the transition region where current abruptly changed. This was useful to the full computerized algorithm in analyzing plasma parameters.

We developed the full computerized algorithm imitating manual analysis of the probe characteristic. The algorithm utilized the characteristics of the first and second derivatives to partition I-V curve into three regions. The range of the transition in the curve could be defined from the maximum to minimum positions of the second derivative. For the ion and electron saturation regions, the characteristic of the first derivative curve was utilized to determine these regions, which corresponded to two almost linear responses on both sides of the maximum of the derivative. Then linear fitting techniques could be applied in each interval to obtain ion current and plasma potential. Finally, electron-temperature calculation was computed from the invert slope of the linear fitting in the range between the end position of the ion-saturation region and the maximum of the first derivative.

For the experimental data acquired from different plasma discharges, the result of the automated algorithm agreed with the result obtained from the manual process. Those results were in consonance with each other for all plasma parameters, such as floating and plasma potentials, electron temperature, and plasma density. However, slight difference in results might take place. This difference came from the process of defining each interval, such as ion-saturation, transition, electron-saturation regions, and electron temperature calculation.

In brief, the full computerized algorithm we have developed can perform well in analyzing plasma parameters. And those results are also in correspondence with the results obtained from the manual calculation. Furthermore, the automated algorithm will also reduce time consumption in analysis when comparing with the manual calculation.