Bulletin of Electrochemistry 6 (1) January 1990, pp 178–179

PC-based on-line signal analysis for voltammogram

R Kalidoss, Thirumalai Parthiban, G Radhakrishnan and A Sundara Raj

Central Electrochemical Research Institute, Karaikudi-623 006, INDIA

Recording and analysis of low frequency signal is typically used in electrochemical experiments such as cyclic voltammetry, coulometry etc. In all these experiments a pair of variables, such as voltage and current (cyclic voltammetry) or variation of a single variable with time or a change or decay with time (coulometry) is typically to be recorded for subsequent analysis. The use of a PC for recording and processing of low frequency signal is presented in this paper.

Key words: PC-based on-line signal analysis, voltammetry, low frequency signal

INTRODUCTION

After the advent of micro computers a large number of papers on data acquisition and processing in electroanalytical applications have appeared in the literature [1–4]. As digital computers are inherently noisy devices which transmit digital noise to the sensitive analog portion of the circuit, the acquired signals must be processed further.

In the present paper the use of a IBM PC for analysis of different waveforms resulting from an electrochemical experiment is described. Electrochemical experiments like voltammetry, commonly requires very low frequency pulses of the order of 0.01 Hz to 1 Hz. Noises incurred in acquisition of such low frequency signals can be eliminated with the developed software.

EXPERIMENTAL

The electrochemical signal analysis system consisted of a PC with an I/O card linked to the IBM bus, an analog to digital converter, three electrode potentiostat and a test cell (Fig. 1). A home made fast analog to digital converter with an IC ADC 0800 was used. A Plotter(HP7475A) was linked to the computer through IEEE488 bus for recording the processed signals.

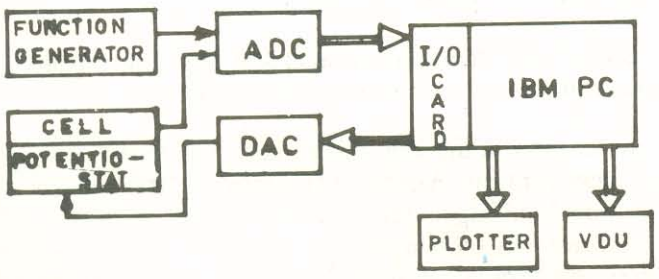

Fig. 1: Block diagram of signal analysis system

The I/O peripheral contained an I. C. 8255 chip which was programmed to input or output data by writing the command register. First part of the software initialises the I/O ports and writes in the command register. The data was sampled two to three times and the data analysis was done in the next part of the software.

To test the performance of the signal analysis system, pure sine wave of different frequencies (0.01 to 1 Hz) from a generator were fed to the A/D converter, which transferred the data to the computer through the I/O card. The software performed the data acquisition in on-line and the data was stored in a data file for further processing in off-line [5]. The data is smoothened by a smoothing routine. The smoothened curve was plotted in the plotter using HPGL language [6]. The main program was written in BASIC language.

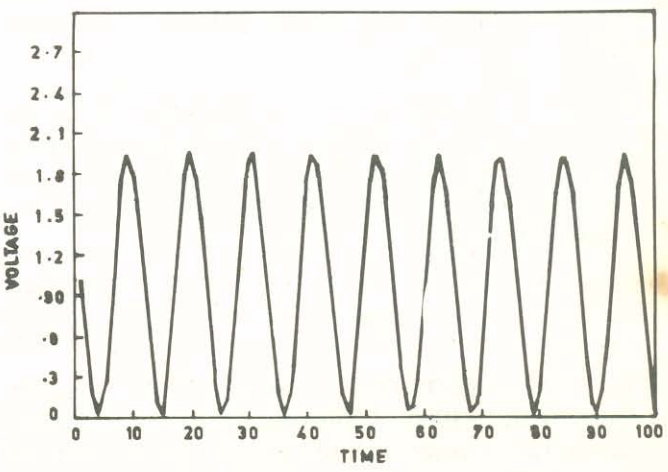

Fig. 2: Recorded sine wave (0.01 Hz)

0256-1654/90/$ 3-50/

A test electrochemical system for trace level estimation of mercury ion was linked to the set up. The data was acquired as before and the voltammogram was plotted.

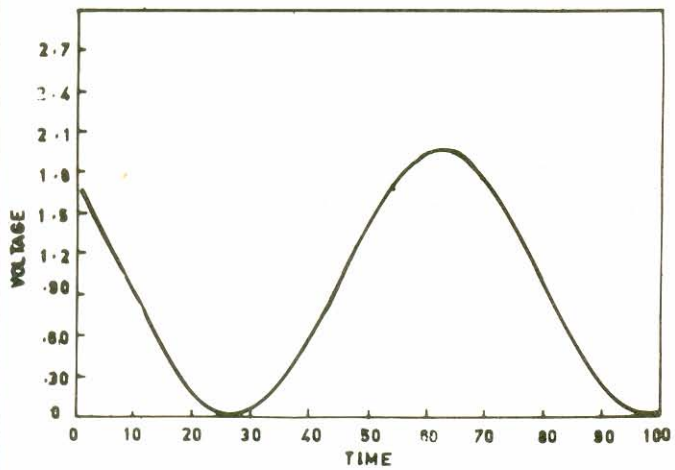

Fig. 3: Recorded sine wave (1 Hz)

RESULTS AND DISCUSSION

The performance of the signal analysis system is tested for different frequencies in the range of 0.01 Hz to 1 Hz. Typical curves are shown in Figs. 2 and 3. Since the number of sampled data points for frequency 0.01 Hz is large compared to the frequency 1 Hz, the curve for the former is smoother. The recorded voltammogram is given in Fig. 4. The developed system is versatile and has several advantages over the analog method of plotting a voltammogram, reading and recording of data points.

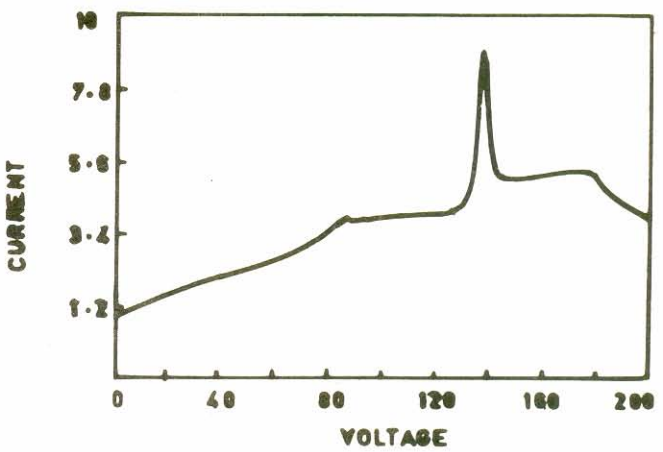

Fig. 4: Voltammogram [estimation of Hg]

REFERENCES

1. R E Dessy, J A Titus and P J Vuuren, *Anal Chem*, **46** (1974) 1055
2. S C Rifkin and D H Evans *Anal Chem*, **48** (1976) 1616
3. A M Bond and B S Grabaric, *Anal Chem*, **51** (1979) 337
4. A M Bond and B S Grabaric, *Anal Chem*, **88** (1977) 2276
5. IBM PC hardware and software programming manual
6. HP graphics language programming manual