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# II. Experimental Techniques

## A. Electrical

### 1. The measurement problem.

The voltage produced by a Hall effect sample is

$$V_H = RHI/t \qquad \text{(II-1)}$$

where $V_H$ - Hall voltage

$H$ - magnetic field in gauss

$I$ - current in amps

$t$ - thickness in cm

$R$ - Hall constant in volt-cm/amp - gauss

We can estimate the Hall voltage produced by a typical alkali, sodium. Using $R = 21 \times 10^{-13}$ volt-cm/amp - gauss, $H = 6000$ gauss, $I = 3$ amps, and $t = .05$ cm, we obtain $V_H = .75$ microvolts. As we measure the voltage produced when the magnetic field is reversed we actually measure $2V_H$ or 1.5 microvolts.

If we estimate a change of about 10 percent in the Hall voltage in 15,000 kg/cm$^2$ and wish to measure this change to at least 10 percent, we must resolve changes of 1 percent in $V_H$. This means we need a measuring system that can resolve $10^{-8}$ volts.

### 2. The choice of an ac or dc method.

Hall voltage measurements may be performed using either an ac or dc system. In an ac system a dc magnetic field and an ac sample current can be used. The Hall voltage is then an ac voltage having the same frequency as the sample current. Such a system is described in detail by Lavine [1,2]. Its advantages include the elimination of contact, thermoelectric, and thermomagnetic potentials. Furthermore, ac amplifiers provide sensitive detectors. Lavine also pointed out a serious defect of the ac method. The high currents, of the order of an ampere, flowing through the sample cause it to vibrate in the