CORRECTION OF FREQUENCY FUNCTIONS FOR OBSERVATIONAL ERRORS OF THE VARIABLES

ROBERT J. TRUMPLER
UNIVERSITY OF CALIFORNIA

1. Introduction

In astronomy statistical distributions or frequency functions are often established empirically from observational data that are affected by appreciable measuring errors. The problem of correcting frequency functions for the effects of observational errors is therefore of great importance and has received considerable attention. In the following we shall briefly summarize the solutions applicable under various conditions.

2. One variable directly measured

For a given population or sample of stars we want to study the distribution according to one variable x. We assume that for each individual of the population a measured value ξ of the variable is available and that we have established the frequency function $F_0(\xi)$ from these data. To find the frequency function $F_t(x)$ of the true values x we have to know the statistical distribution of the measuring errors ϵ. In the most general case the error distribution may vary with x, the quantity measured; it must be considered as an array distribution

$$\Phi(\epsilon|x)$$

where x is to be treated like a parameter.

The three variables x, ξ, ϵ are subject to the condition

$$\xi = x + \epsilon,$$

and the corresponding relation between the frequency functions can be written in the two forms

$$(1) \qquad F_0(\xi) = \int_{-\infty}^{+\infty} F_t(x)\,\Phi(\xi - x\,|\,x)\,dx$$

$$= \int_{-\infty}^{+\infty} F_t(\xi - \epsilon)\,\Phi(\epsilon\,|\,\xi - \epsilon)\,d\epsilon.$$

When $F_0(\xi)$ and $\Phi(\epsilon|x)$ are known this is an integral equation (Fredholm's first kind) for the determination of $F_t(x)$.

The most important special cases are:

(a) The error distribution is independent of x.