Figliola & Beasley, Theory and Design for Mechanical Measurements, 3rd Ed

Table 4.4 Student-t Distribution

ν	t_{50}	t_{90}	t_{95}	t_{99}
1	1.000	6.314	12.706	63.657
2	0.816	2.920	4.303	9.925
3	0.765	2.353	3.182	5.841
4	0.741	2.132	2.770	4.604
5	0.727	2.015	2.571	4.032
6	0.718	1.943	2.447	3.707
7	0.711	1.895	2.365	3.499
8	0.706	1.860	2.306	3.355
9	0.703	1.833	2.262	3.250
10	0.700	1.812	2.228	3.169
11	0.697	1.796	2.201	3.106
12	0.695	1.782	2.179	3.055
13	0.694	1.771	2.160	3.012
14	0.692	1.761	2.145	2.977
15	0.691	1.753	2.131	2.947
16	0.690	1.746	2.120	2.921
17	0.689	1.740	2.110	2.898
18	0.688	1.734	2.101	2.878
19	0.688	1.729	2.093	2.861
20	0.687	1.725	2.086	2.845
21	0.686	1.721	2.080	2.831
30	0.683	1.697	2.042	2.750
40	0.681	1.684	2.021	2.704
50	0.680	1.679	2.010	2.679
60	0.679	1.671	2.000	2.660
x	0.674	1.645	1.960	2.576

described does not provide a reliable weight estimate of the true probability. However, the sample variance can be weighted in such a manner so as to compensate for the difference between the finite statistical estimates and the infinite statistics for a measured variable. For a normal distribution of x about some sample mean value, $\bar{x}$, one can state that statistically

$$x_i = \bar{x} \pm t_{\nu,P} S_x \quad (P\%) \tag{4.15}$$

where the variable $t_{\nu,P}$ is obtained from a new weighting function used for finite data sets and that replaces the z variable. This new variable is referred to as the t estimator. The interval $\pm t_{\nu,P} S_x$ represents a precision interval, given at probability $P\%$, within which one should expect any measured value to fall.

The value for the t estimator is a function of the probability, P, and the degrees of freedom, ν, in the standard deviation. These t values can be obtained from Table 4.4, which is a tabulation of the *Student-t distribution* as developed by William S. Gosset[4] (1876–1937), who recognized that the use of the z variable with S_x in place of σ was not reliable. Careful inspection of the t chart shows that the t value inflates the size of the interval required to attain a percent probability, $P\%$, to describe x. That is,

[4] At the time, Gosset was employed as a brewer and statistician by a well-known Irish brewery. You might pause to reflect on his multifarious contributions.