Comparison of advantages and evaluation theories for two air tightness models

Items	Quadratic model: $\Delta p=D_1\cdot q+D_2\cdot q^2$	Power law model: $\Delta p=D_n\cdot q^n$
Appearance	Complicated	Simple
Basis	Derived from physics and theoretical	Empirical equation by experiment
Measurement Analysis	The accuracy of least squares regression is relatively good.	Least squares regression in logarithmic scale results in poor accuracy.
Predictive Calculations (NETS)	The quadratic equation can be folded into the cubic equation which represents the blower P-Q performance and the blower's operating point can be easily solved analytically using the Cardano's formula.	The quadratic equation must be approximated from the power law equation. In NETS this is performed by least squares applying assumed dozens of pressure differences in the rage of 0.1 [Pa] to 100 [Pa] and these resulting air flow rates.

We used the robust Tukey's Biweight method to estimate the two coefficients of the power law model. To evaluate the accuracy of this method, we derived a method and reliability evaluation index that considers not only the measurement uncertainty but also the failure of the measurement assumptions. We also developed a spreadsheet program. Ref.[97]

Hiroyasu Okuyama, Yoshinori Onishi, Reconsideration of parameter estimation and reliability evaluation methods for building airtightness measurement using fan pressurization, Elsevier, Building and Environment, 47 (2012), pp373-384

Since a practical method for evaluating the standard deviation of measurement uncertainty, which is necessary for evaluating reliability, has not been clear until now, we have proposed a statistical process for the deviations from the smoothed curve by moving average. Ref.[109]

Hiroyasu Okuyama, Atsumasa Yoshiura,Wataru Nakajima," Theoretical and experimental study of a field measurement method for the thermal, ventilation, and air-tightness performance of residential houses", Proceedings of Annual meeting of SHASE-J (Kagoshima), E-9, Sep.2016, p113-116