

Lamnauer N. Using Order Statistics for Estimating Lower and Upper Size Bounds / N. Lamnauer, O. Kupriyanov // Advances in Design, Simulation and Manufacturing IX. Proceedings of the 9th International Conference on Design, Simulation, Manufacturing: The Innovation Exchange, DSMIE-2026, June 2-5, 2026, Almaty, Kazakhstan. – Vol. 1: Manufacturing Processes and Intelligent Production Systems Lecture Notes in Mechanical Engineering. – Springer, Cham, 2026.

Abstract:

The paper proposes a new method for estimating the upper and lower bounds of sample size values of parts, based on determining the first and last order statistics of a bounded unimodal random variable. The method is characterized by its applicability to any unimodal distributions of sizes and does not require the use of a confidence probability in its reasoning. Distribution functions were found with the necessary condition for the existence of the mode of the last and first order statistics for any bounded random variable. Using these distributions, estimates for the upper and lower bounds of the bounded random variable were obtained. The relationship between the theoretical range and the empirical range, as determined by the sample size, allows for the required sample size to be defined based on a given accuracy. The application of the mathematical framework is illustrated with two examples of fuel equipment part sizes. The proposed method can be useful for quality control of size processing, determining the experimental strength of joints, and other applications related to processing experimental data. One of the most promising applications is the construction of control charts with regulation limits for the production process.

Keywords:

experimental data processing, probability distribution of a random variable, allowable value limits, sample size.