



## **An Application of Monte Carlo Method for the Uncertainty Estimation in the Case of Non-Linear Measurement Equation: an Engineering Approach**

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### **Abstract:**

Since its introduction, nearly 70 years ago, Monte Carlo (MC) has become an important tool in many fields and applications [1] as well as useful method when the uncertainty propagation equation cannot be applied. MC is a technique that handles non-normal distributions, complex algorithms and correlations between input variables for the considered model. In this case a distribution has to be determined for each variable, the data are generated for each one, and they are used as input for the model to produce output. Since 2011 this method is recommended by the BIPM for evaluation of measurement data [2] and it can be say that it revolutionizes the determination of measurement uncertainty. The availability of MC calculation tools may remove the need for special knowledge in the construction of measurement models in all fields of engineering, science and environment analysis. The conventional uncertainty analysis called as GUM approach requires approximation at each step of procedure causing serious doubts on the validity of the results.

The first part of this paper deals with the GUM method [3] applied for the estimation of power factor value uncertainty. The pf value is achieved with the use of wattmeter PX110 that enables to simultaneous measurements of voltage, current and active power. The pf is a function of three correlated input variables (V, I and P). The second part presents the application of MC simulation with the use of popular spreadsheet. The comparison of the results obtained with the both methods is also described.