# Need and Difficulties in Uncertainty of Measurement

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## ABSTRACT

*Uncertainty of measurement has attracted more research in recent past. In this paper, an attempt is made to explain the concept and need of measurment uncertainty. The uncertainty of measurement is related to measurement and calibration process only. The uncertainty of measurement(UOM) is applied in various application such as mechanical, chemical, electrical and civil testing equipments. The paper focus on difficulties in estimation of sources of uncertainty and their estimation. The gaps in the research are identified along with the scope of UOM in various application.The effects of qualitative factors can be possible using data collection through questionnaire.*

*Keyworks: Cost Effects, Errors, Lab Accrediation, Machine Interference, Uncertainty of Measurement*

## INTRODUCTION

The overall purpose of performing measurements in science is to increase knowledge and document this knowledge about some physical quantity. The measurand has a true value but, except for straightforward counting situations, the true value can never be fully determined. When a quantity is measured, the outcome depends on the measuring system, the measurement procedure, the skill of the operator, the environment and other effects. In practice the uncertainty on the result may arise from many possible sources, including examples such as incomplete definition, sampling, matrix effects and interferences, environmental conditions, uncertainties of weights and volumetric equipment, reference values, approximations and assumptions incorporated in the measurement method and procedure and random variation (Horwitz & Albert, 1997). The source of uncertainty varies from application to application.

The objective of this study is to:

- Define need of uncertainty of measurement (UOM) research;
- Explore the trends in UOM research and suggest the research agenda for future work.

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## Uncertainty of Measurement

Uncertainty of Measurement has been interpreted by various researcher .A measurement tells us about a property of something. It might tell us how heavy an object is, or how hot, or how long it is. A measurement gives a number to that property. Measurements are always made using an instrument of some kind. Rulers, stopwatches, Weighing scales and thermometers are all measuring instruments. The result of a measurement is normally in two parts: a number and a unit of measurement, e.g. 'How long is it? ... 2 meters.' *Uncertainty of measurement* is the doubt that exists about the result of any measurement. But for every measurement - even the most careful - there is always a margin of doubt. The definition of the term uncertainty (of measurement) used in this protocol and taken from the current version adopted for the International Vocabulary of Basic and General Terms in metrology is:"A parameter associated with the result of a measurement, that characterizes the dispersion of the values that could reasonably be attributed to the measurand**"** (BIPM/IECIIFCC/ISO/OIML/IUPAC, n.d.).

Measurement errors are never known exactly. In some instances they may be estimated and tolerated or corrected for; or they may be simply acknowledged as being present. Whether an error is estimated or acknowledged, its existence introduces certain amount of measurement uncertainty (Castrup, 2001).

This brings us to an operational definition of measurement uncertainty. Since measurement error is the discrepancy between the value of a parameter and a perceived or measured parameter value, we can think of measurement uncertainty as either a lack of knowledge concerning the value of a measured parameter or as a lack of knowledge concerning the *error* in the parameter's measurement. The latter view provides a workable framework for analyzing measurement uncertainty (Kracker, 2007).

# UNCERTAINTY: WHY EVALUATE IT?

An increasing proportion of standards users realize the great benefits of utilizing measurement uncertainty to optimize design codes, improve process control and the quality and performance of their products. Meaningful uncertainty statements can reduce costs. It is a requirement for all accredited calibration laboratories that results reported in a calibration certificate are accompanied by a statement describing the uncertainty associated with these results. It is also a requirement for test laboratories under the following circumstances:

1. Where it is required by the client;
2. Where it is required by the specification calling up the test; and
3. Where the uncertainty affects compliance to a specification or limit.

Uncertainty evaluation is also recommended for the test laboratory to understand which aspects of the test procedure have the more effects on the results so that such aspects may be closely controlled or monitored (JCGM 100:2008, 2008).

## Error, Bias and Uncertainty

When we measure a physical parameter by any means (e.g., eyeballing, using off-the-shelf instruments, employing precise standards, etc.) we are making an estimate of the value of the quantity being measured. The features of such estimates are measurement error, bias and measurement uncertainty as shown in Figure 1.

### *Measurement Error*

The difference between the value of a measured quantity and its true value is referred to as *measurement error*. Measurement error may be systematic or random: