THE THEORY OF EVIDENCE. A NEW MATHEMATICAL APPROACH TO REPRESENT MEASUREMENT REULTS AND THEIR UNCERTAINTIES.

It is widely recognized, by the scientific and technical community, that measurements are the bridge between the empiric world and that of the abstract concepts and knowledge. In fact, measurements provide us the quantitative knowledge about objects and phenomena.

It is also widely recognized that the measurement result is capable of providing only incomplete information about the actual value of the measurand, that is, the quantity being measured. Therefore, a measurement result becomes useful, in any practical situation, only if a way is defined for estimating how incomplete is this information.

The more recent development of the measurement science has identified the uncertainty concept as the most suitable way to quantify how incomplete is the information provided by a measurement result.

However, the problem of how to represent a measurement result together with its uncertainty and propagate measurement uncertainty is still an open issue in the field of metrology, despite many contributions have been published in the literature over the years.

Currently, measurement uncertainty is treated in a purely probabilistic way, as recommended by the Standard Organizations recommendations.

However, the research done in the last ten years have shown some drawbacks of this approach.

A new mathematical theory has been proposed as the mathematical support for measurement uncertainty: the Theory of Evidence, a quite new mathematical theory, proposed by Shafer in 1976.

The Theory of Evidence is a more general theory than the well known probability theory, and appears more suitable for representing and processing measurement results with their associated measurement uncertainty in all general situations, when different kinds of uncertainty contributions are present (random, systematic, unknown).

The aim of the tutorial is to show how the approach to the expression of measurement uncertainty based on the Theory of Evidence allows one to overcome some limitations, both theoretical and practical, of the purely probabilistic approach.