Title of the dissertation: Advances in Humidity Standards

Contents of the dissertation:
Reliable humidity measurement is attracting an increasing interest due to its crucial role in the industry, meteorology, pharmaceutical manufacturing, electronics, food industry and air conditioning. Metrological traceability to SI through appropriate humidity standards is a key to the reliability needed in these applications. This work addresses improved humidity standards by developing new calculation methods and calibration systems and approaches in the following areas:

1- A novel approach for water vapor enhancement factor formulation:
This section presents the numerical implementation of different approaches to estimate the water vapor enhancement factor as well as a new functional equation for metrological applications.

2- A humidity generator for dew-point temperatures above 100 °C:
It presents design, development and validation of a humidity generator which exploits a microwave resonator as its reference. This work is aimed to extend the world-class humidity standards up to 140 °C in terms of dew-point temperature with a potential industrial impact to save up to 30 M€/year in Europe.

3- Non-static calibration of second-order probes:
It introduces the theoretical basis for a generic non-static calibration of second order probes to chain their measurements to the highest SI-traceability hierarchy level for the entire operating range in the shortest time. (e.g. 30 times faster than conventional methods for RH sensors)

4- A neural network-based uncertainty algorithm:
It introduces NNUA as an iterative algorithm aimed at propagating input uncertainties and/or PDFs in MIMO, nonlinear and computationally expensive mathematical models. This uncertainty algorithm assures similar results to that of adaptive Monte-Carlo method with much higher efficiency in a mathematically sound manner (e.g. 6800 times faster convergence for a worked example).

Field of the dissertation: Measurement Science and Technology

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Custos:
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