



MATHMET

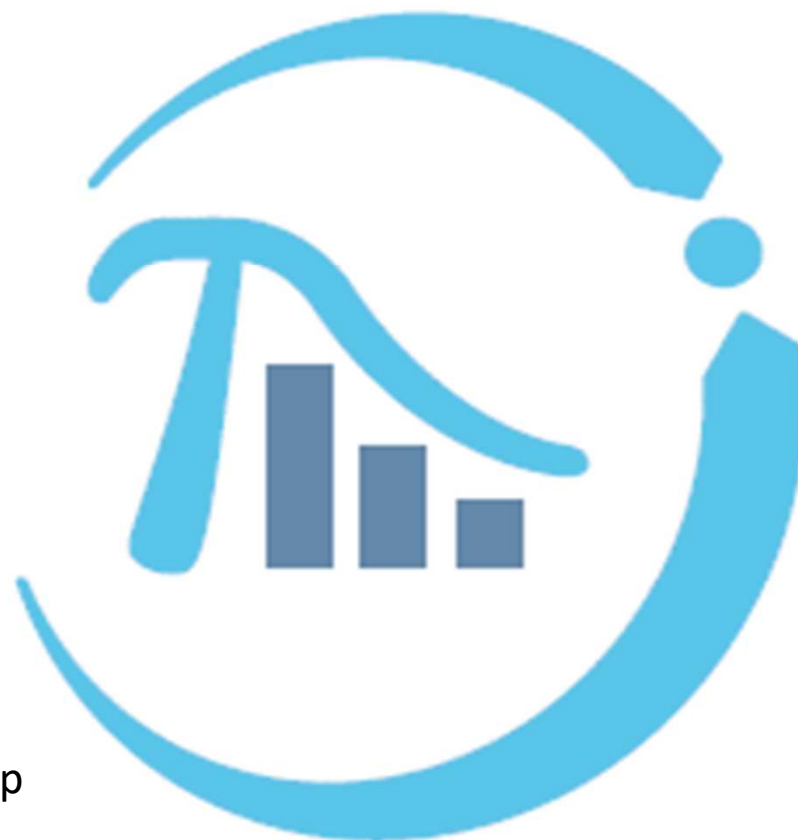
Sharing best practices in MU training - INRIM

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MATHMET Activity MU Training, Skills Workshop



MATHMET



What makes the course unique

Experience from INRIM (Francesca Pennechi)

Main message

- Experience of many repetitions of two PhD and one course for calibration and test laboratory employees (*courses from other INRIM colleagues not addressed here*). Contents, degree of details and choice of examples are tailored to the specific kind of course.
- Good degree of detail on **probabilistic and statistical basis** for the MU evaluation.
- Strong focus on the **limits of applicability of the GUM framework** and **comparison of results with the MCM approach**.
- Attention to comprehension and evaluation of **input and output covariances** and treatment of **multivariate models** (by LPU and MCM).
- Some hints at **Bayesian approaches and conformity assessment** (JCGM 106) provide a more general framework for MU and related impact.

Take home message

- Awareness of pros and cons of both the GUM approach and the MCM.
- Sufficient level of confidence in dealing with multivariate models.



Lessons learnt

Experience from INRIM (Francesca Pennecchi)

Main message

- An **increasing level of difficulty in the proposed examples** (up to examples of the analytical propagation of MU) and the application of different MU propagation techniques to the same example **gradually lead the students to more complex situations**.
- A specific example (also in the EMUE Compendium) on the **failure of the GUM approach** for determining coverage intervals and, at the same time, on the **failure of the MCM** for estimating the measurand and the standard uncertainty: it rises awareness on the risks of a blind application of a MU methods.

Take home message

- To convey the message that MU evaluation is not a blind “press the button” of some tools (choice and implementation of the appropriate method rely on the available knowledge and a critical judgment based on it).



Tricks and tips

Experience from INRIM (Francesca Pennechi)

Main message

- Students are asked (during the lesson) to solve an easy exercise by applying JCGM 100 and 101 with the use of the **NIST Uncertainty Machine**, SW that is presented quite in detail.
- **(R) codes**, developed for solving the examples treated in the course, are provided to the students. Several **SW for MU evaluation** which are freely available on the internet are mentioned.

Take home message

- Use of dedicated SW makes the application of theoretical tools more friendly and easily reproducible “at home”.



Idea or dream yet to fulfill

Experience from INRIM (Francesca Pennechi)

- Good theoretical background is provided but **no hands-on example**.
- MU evaluation for Weighted Total Least Squares regression is addressed as a case study of uncertainty propagation through an implicit model, however a **fully treatment of MU for regression problems in general is missing**.

Main message

Take home message

- To reach a better balance between theory and practice (use more examples and more realistic).
- To provide a comprehensive, easy and effective treatment of MU for regression problems (very much needed for calibrations).