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Professorship in Biorefinery Measurements

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1 Background

The Faculty of Technology at the University of Oulu, Oulu, and the Kajaani University Consortium, Kajaani, have launched a full professorship position in Biorefinery measurement. This five-year post strengthens the focus area 'Creating Sustainability through Materials and Systems' of the University of Oulu. The professorship is located in Kajaani and Oulu. It is a part of the Faculty of Technology and Control Engineering Research unit at the University of Oulu. The other financiers of the Professorship together with the University are Kajaani City, Kainuun Liitto, St1 and Valmet. The work takes place both in Kajaani and Oulu campuses. A research group of 3 – 4 researchers will support Professor Mika Ruusunen.

2 Research focus

The field of the Professorship focuses on on-line measurements in production processes of bio-based industries, especially in areas related to biochemistry of wood and wood-based materials. The main areas of the research include

- Analysis and measurements in modern biorefinery, its side streams and side products,
- Optimizing/optimal control of these production processes also from the biochemical viewpoint and the role of measurement technologies in there,
- Measurement needs coming from authorities: environmental permits, safety issues,

- Research on the future replacement of existing off-line and laboratory technologies with reliable on-line measurements.

Many of the present processing issues in the content of biorefinery concepts are due to variation in quality of biomass feedstock and its other properties. There, new measurement technologies can enable plant-wide compensation strategies for these issues. For this, research aims to develop reliable and predictive on-line measurements of the key variables for biorefinery processes. This includes then systematic process identification, designed laboratory experiments, and field tests for exploring process interactions and dynamics as a plant wide.

The reliability and traceability of the on-line measurements plays an increasingly important role. On the other hand, existing and novel measurement principles or technologies may require new (re)-calibration and continuous performance assessment methods in order to be implemented to automation system and to function properly. Moreover, methods to validate and maintain whole measurement system need to study further. Then, on-line measurement uncertainty estimation and self-validation development, both with hardware and software based measurements, are of importance.

3 Results

The first active research topics relate to the remote measurements and control of distributed bio-product mills processing organic residues. In addition, a novel principle for real-time estimation of moisture content in sawdust has been explored (paper 36: On-line moisture content estimation of saw dust via machine vision, Authors: Art Valta, Mika Ruusunen and Kauko Leiviskä).

The research history has shown that a proper implementation of new measurement systems requires close collaboration also between the authorities and companies. This calls for co-operation with accredited measurement laboratories (reference measurements) and authorities (legislation, accreditation).