

## POSITION 5 (Automation)

Research on automation is conducted in the Luminous and Multi-Scale Testing Research Communities. The research covers a wide range of fields, including methods of control and systems engineering, process supervision and control room design, machine automation and diagnostics. Applications of automation in industrial and energy processes, mechatronics, robotics, construction and mining are also included in the research focus, see Automation Research Community, [www.oulu.fi/tech/node/27693](http://www.oulu.fi/tech/node/27693).

Performance and energy efficiency of both large-scale and small-scale machines and processes have become important research topics with the growing significance of sustainability and resource efficiency. Moving machinery have been set under close consideration as it is widely known that their energy efficiency is not optimal and they are widely used throughout the whole world. Learning the dynamics of individual components and controlling the operation of systems composed of many components are of importance for optimization of energy generation/production, storage and consumption.

*1 four-year PhD student position will be available for the development of a high performance and energy efficient systems in the field of machine engineering and dynamic energy systems optimization.* In this position, the candidate should be interested and competent to do research in:

### **1. Designing of energy efficient machine components and systems as well as their experimental research facilities**

Most of the moving machines can be seen as autonomous and dynamic energy systems consisting of energy generation, transmission, conversion and consuming elements. In order to ensure efficient and reliable operation of such a machines, their energy management systems must designed carefully and the individual components must combine seamlessly. The objective of this student position is to develop design methods and facilities to enable the development of more efficient and environmentally friendly machines taking advantage of virtual design and digitalization of machine components.

and/or;

### **2. Identification and optimization aspects from the perspective of system dynamics, control and automation**

Optimal operation of energy systems is a challenging constrained dynamic optimization problem. Successful optimization requires combination of physical simulation models with data-based identification techniques, application of numerically efficient optimization techniques, and means for analysis of complex system dynamics. The design should result in control schemes implementable in real world applications. The objective of the student position is to examine and develop methods for optimal operation of dynamic energy systems.

Overlap between the items is highly encouraged. For further information: Dr. Toni Liedes ([toni.liedes@oulu.fi](mailto:toni.liedes@oulu.fi)) (Mechatronics and Machine Diagnostics Research Group) or Prof. Enso Ikonen ([enso.ikonen@oulu.fi](mailto:enso.ikonen@oulu.fi)) (Systems Engineering Research group).