Automation in context: Beyond islands of knowledge and technologies

Present requirements to efficiency, availability, flexibility and safety of large scale industrial processes and technical infrastructure cannot be satisfied without advanced automation. The high societal importance of automation will increase further in a future with growing needs for green and sustainable technologies and increasing challenges in handling the interactions between complex production and distribution technologies and information technology. These challenges cannot be met without the intelligence provided automation system.

Traditionally automation systems have been considered as a means to achieve purposes defined in relation to the values created by other technologies, and the competence of the engineer has been to know ***how to automate*** using electronics and information and communication technology. However, the challenges of the future will also require methods and tools to analyze ***why and what to automate*** in order to be able to see automation systems as elements of larger systems comprising other technologies, users and operators. The value added by automation can in this way be optimized and the intelligence can be increased so that automation not only adapt to the dynamics of the automated system but also to changes in the purposes and functions of the whole system. This trend is clearly visible within ongoing research in future power systems for distributed generation based on renewable energy resources.

We need therefore to change our traditional understanding of automation so that it is also seen in a context of use and on an equal level with other technologies.

The first generation of automation was a means of reducing production costs. The intelligence in future 2nd Generation Automation systems will be value creating by enabling processes and satisfaction of requirements to efficiency, availability, flexibility and safety which could not be otherwise realized.

This vision about 2nd Generation Automation implies research challenges within modeling purposes and functions of complex automated systems, methods for integrated design, development of new automated functions and new systems architectures.

Challenges and research directions within 2nd Generation Automation will be illustrated by ongoing research projects at Technical University of Denmark including activities within development of the future electrical power system of Denmark.

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