

Executive Report IBA A Production industry

1. Scope

The problem of adaptability and transferability of systems is of prime importance in production industry. There exists a particular need for research and technology transfer in this area, as currently available systems, use traditional control theory in a large scale but their adaptivity specially in complicated models (or in the absence of a mathematical equivalent model) is questionable. Transferring existing solutions in new installations can sometimes mean redesign from scratch and increase the cost significantly.

Production Industry applications can be subdivided in Primary Industry applications (mainly heavy industry like metallurgy, rubber industry, textile industry etc.) and Components and Consumer Goods Industry applications (electronics, household appliances etc.). In both sectors examples of Smart Adaptive Systems were shown to increase efficiency and lead to better organisation of the production line.

2. Status of Smart Adaptive Systems in The Domain Covered by IBA A.

Industrial automation is now in the phase where intelligent methods are reaching the degree of maturity required by the end users. The broad application of Smart Adaptive Systems corresponds to the next logical step in complex industrial applications. The degree of penetration and the success of smart adaptive systems depends very much on the degree of “smartness” of the considered systems. The first level of Smart Adaptive Systems corresponds to systems adapting to a changing environment. Applications in that fields are numerous. Steps towards the second level of smart adaptive systems, i.e. to adapt to similar settings without explicitly being ported to them, include several approaches. The third level of smart adaptive systems, i.e. growing into an application, is the most demanding. Multiresolution search with adaptive search strategies provides an example of a tool for this.

During the course of EUNITE, great progress have been made towards the acceptance of Smart Adaptive Systems in complex industrial environments. At time, Smart Adaptive Systems are mostly in a pre-industrialized phase. The penetration of new ideas and technologies in the industrial field takes always quite some amount of time, as a careful industrial validation stage is a pre-requisite.

Intelligent systems have found various applications in the pulp and paper industry (for details, please refer to the roadmap), in mineral and metal industries (for instance for intelligent diagnosis and faults detection systems), chemical industries, energy industry... Smart adaptive systems have enormous potential in oil and gas industry from process control to crude oil purchase. A new need for Smart Adaptive Systems emerges clearly in relation to the processing of the huge amount of data furnished by modern instrumentation systems. The degree of similarity between the required tasks in different industries leads us to postulate that the highest level of “smartness”, corresponding to adaptive systems that are portable to other applications, might be reached first in connection to intelligent data processing.

In the production of electronic components, smart adaptive applications have been reported in managerial decision making, functional testing of products, inspection and condition monitoring of production equipment. Other applications are found in the pharmaceutical industry, in biotechnology, automotive industry or robotics.

3. Main Activities

Extensive roadmap on “Smart Adaptive Systems” covering the scope of IBA A: Intelligent systems developed for various applications provide basis for functions and features of smart adaptive systems. Processes and systems focus on combining these functions and features in smart adaptive applications. Also

interactions of intelligent subsystems have been studied from different aspects. Various learning mechanisms can be used in this interacting environment. Important question is when learning is needed? Intelligent applications can be built by using various methodologies. Experiences are collected in the methodological section. Intelligent methodologies need supporting tools and methodologies for performance evaluation, tuning and learning.

Workshops and Seminars

- TOOLMET'01 Symposium – Tool Environments and Development Methods for Intelligent Systems, Oulu, Finland, April 19-20, 2001: EUNITE network was introduced, totally 14 papers prepared by 33 authors from 4 countries.
- Two sessions on production industry during Eunate 2001, Puerto de la Cruz, Tenerife, Spain, December 13-14, 2002: 10 papers prepared by 25 authors from 8 countries.
- [Intelligent Methods for Quality Improvement](#)
- Seminar on Adaptive Techniques in the Paper and Board industry
- IBA A Meeting 'Process Analysis, Modelling and Control using Smart Adaptive Systems (SAS)', Oulu, Finland, March 22, 2002: industrial roadmap meeting with 13 participants, several industrial areas.
- Workshop 'Wavelets Applications in Soft Computing and Intelligent Technologies' at Eunate 2002 Symposium, Albufeira, Portugal, September 21, 2002: 4 papers prepared by 5 authors from 4 countries.
- Workshop 'Process Analysis, Modelling and Control using Smart Adaptive Systems (SAS)' at the Eunate 2002 Symposium, Albufeira, Portugal, September 20, 2002: 8 papers prepared by 49 authors from 10 countries.
- Workshop 'Process Analysis, Modelling and Control using Smart Adaptive Systems (SAS)' at the Eunate 2003 Symposium, Oulu, Finland, July 10-12, 2004: 19 papers prepared by 43 authors from 14 countries.
- Roadmap workshop, Nijmegen, The Netherlands, January 23-24, 2004: industrial roadmap meeting with 9 participants, different industrial areas.
- Workshop 'Process Analysis, Modelling and Control using Smart Adaptive Systems (SAS)' at the Eunate 2004 Symposium, Aachen, Germany, June 10-11, 2004: 18 papers prepared by 48 authors from 16 countries.

Workshops and sessions at Eunate symposia have had totally 69 papers prepared by 170 authors from 23 countries. Sessions were well attended, and the contributions and discussions have had an important impact on the roadmap. The programmes of these workshops were planned to support the roadmap work. New areas were covered by invited speakers:

- 2002: hybrid methodologies,
- 2003: intelligent applications and learning,
- 2004: integration of intelligent applications to smart adaptive systems.

Special call for papers was used for getting papers from the focus areas:

- adaptive control,
- fault diagnosis and performance monitoring, and
- learning.

Some papers were got through the general call for papers.

In addition to the workshops and sessions, two specialised roadmap workshops were organised. The aim of these workshops was to get response from industry.

Technical Reports & Case Studies:

- [Adaptive Fuzzy Control of a Rotary Dryer](#)
- [Fuzzy Quality Control of a TMP Plant](#)
- [Intelligent Control of a Rotary Kiln](#)

Committee meetings were organised at workshops and seminars.

4. IBA A: Production Industry Committee

Organisation	Department	Contact	Country
BELIMO Automation AG		Marc Thuillard	CH
Czech Technical University in Prague	Faculty of Electrical Engineering	Olga Stepankova	CZ
FL-Soft		Jens-Jorgen Ostergaard	DK
Instituto Superior Tecnico	Electrical and Computers Engineering	Fernando Pereira	PT
National University of Ireland (NUI), Maynooth	Department of Electronic Engineering	John V. Ringwood	IE
University of La Laguna	Chemical Engineering	Jose J. Macias	ES
University of Nijmegen		Tom M. Heskes	NL
University of Oulu	Department of Process Engineering / Control Engineering Laboratory	Esko Juuso	FI
University of Oviedo	Project Engineering	Francisco Ortega	ES
University of Strathclyde	Department of Chemical & Process Engineering	Bruce E. Postlethwaite	UK
Zenon SA	Robotics Informatics	Christos Emmanouilidis	GR

Chairperson: [Marc Thuillard](#), [Esko Juuso](#)