White Paper written for
World Batch Forum
June 2004

900 Fox Valley Drive, Suite 204
Longwood, FL 32779-2552, USA
Phone: +1 (407) 774-5764
Fax +1 (407) 774-6751
E-mail: info@wbf.org
www.wbf.org

White Paper
S88 for Researchers and Scientists

Zofia Verwater-Lukszo
Delft University of Technology
Faculty Technology, Policy and Management
P.O. Box 5015, 2600 GA Delft
The Netherlands

In the last few decades, developments in the global economic structure have changed the environment in which process industries operate. These challenges enhance the complexity of manufacturing operations, and create a need for enhanced flexibility. Many process industries choose for the flexible batch-wise mode of operation in response to these challenges. Batch-wise production of higher added-value specialities is a fast growing segment of the process industry (i.e. food & beverages, chemical, pharmaceutical, metal industry etc.) in most industrialized countries. However, the flexibility of a batch plant poses the difficult problem of the allocation of available equipment for producing a dynamic mix of desired products and setting up a production plan to decide if, when, and in what amounts, products should be produced. Moreover, the dynamic character of processing steps, which do not operate in a steady-state mode, complicates further the operation and control of a batch plant.

Chemical engineering research into methods to support an (eco-) efficient design of batch processes is gaining momentum since a few years. It is striking that, in comparison with batch processes design, the operation of batch processes is hardly explored as a chemical engineering field. To change the situation academic courses should be developed aimed at providing knowledge and understanding of a plant operation in such a way that the challenges imposed by the economic, environmental and social sustainability are made more transparent. It is not sufficient to talk about sophisticated first-principle modelling techniques, rigorous optimisation methods and advanced control strategies. We strongly believe that the above–mentioned scientific methods to be applicable in the industrial practice should be supported by a clear picture of a plant and working processes taking place there. The S88.01 standard, published in 1995 by the Instrumentation, Systems, and Automation Society, (ISA) providing standard models and terminology for the design and operation of batch control systems, gives such a picture.

The ISA batch standard S88.01 "Batch Control. Models and Terminology" provided standard models and terminology for the design and operation of batch control systems. However, it is stressed that the standard "is not intended to suggest that there is only one way to implement or apply batch control". The models described by the standard are independent of underlying control algorithms as well as control systems such as PLC or DCS. In principle, the standard is applicable in any production situation where flexibility is an important issue, with other words where several products may be produced in the same equipment, or the same products may be performed in different types of equipment. Providing that finite quantities of material are produced, the models defined by the standard are applicable to the continuous as well as to the discrete mode of operation.
The aim of the standard is to provide a modular framework for recipe development without any support of a control engineer. In this way no programming in the batch control systems is necessary: the product information is put into recipes and the equipment information into equipment models. A change in a recipe does not require any re-programming in the PLC or DCS applications.

Most of the concepts of batch control are applicable to continuous and discrete industry as well. This fact needs to be highlighted and proved for the industries that can benefit from such a synergy. The integration of the enterprise functions as strategic and tactical management, forecasting, planning, scheduling, recipe management, process execution, optimisation and control are central concepts. To realise this integrated manner of plant management the modern concepts of manufacturing execution systems (MES), plant modelling according to the ISA-S88 and ISA-S95 standards, total quality management and system thinking are very useful. Research is needed in this domain in order to explore and demonstrate good and efficient ways of managing MES systems integrated with batch systems or other types of process controls systems.

Batch process optimisation has made significant advances. Nevertheless, an integrated approach supporting enterprise optimisation is called for. The S95.01 standard published by the Instrumentation, Systems, and Automation Society (ISA), providing standard models for integration of business systems like ERP with manufacturing and control systems, is one of the answers to this call. The responsibility for plant-wide optimisation is managed by the manufacturing system in which process optimisation and appropriate process control on the process-cell level form the necessary conditions. The S88.01 standard, published by the International Society for Measurement and Control, provides standard models and terminology for the design and operation of batch control systems. More research is needed also in the domain of process optimisation.

If you are a researcher or scientists working in the domain of process control, batch, discrete or continuous control, supervisory control, etc, it is definitely worth reading and understanding the concepts of the S88 and S95 standards. We strongly believe that there are many concepts that can be researched upon and the results are definitely of interest for the industries.

More info

The standard can be purchased from ISA (ww.isa.org), the organization that sponsored the development of the standard. Technically, it is known as ANSI/ISA88.00.01. The international version is called IEC 61512-1 and is available from the International Electrotechnical Commission (www.iec.ch). World Batch Forum also provides valuable info regarding conferences, web seminars etc related to S88 (www.wbf.org).