Microprocessors in Process Control

Pierre Radulescu was born in Paris,in 1945. His studies were in Control Engineering at the Polytechnical Institute of Bucharest. He has been working with the Research Institute for Informatics for twenty years. His research interests are mainly placed in the area of process control software. He has been project leader for 15 years and conducted researches in the field of process control.

Dr. John Borer, who works at the Department of Mechanical Engineering ,Brunel University. Uxbridge, U.K., intended his volume as a largely accessible introductory text in microprocessor-based process control.

The technical level of the book is that of control engineers,and the emphasis is put on letting them fully grasp the concepts and the technologies involved.

This book is a reflection of the necessity for getting the theoretical side of control strategy, which has been largely speculated,ever closer to the practical side,i.e. to implementing control strategies.

How microprocessors can help in such a doing is the book's main concern.

Mainly addressing control engineers,the book focuses on how to master and make an effective use of microprocessors,the more so as analog systems,under current use, stayed out of a sophisticated subject-area.

The book goes as deep as possible in all of the important and fundamental concepts of microprocessor-based process control.

The book features well-structured chapters and a gradual elucidation of different topics which readers are encouraged to understand.

A first part will refer measurement techniques in industrial milieux. A setting of the industrial milieu is imagined and explained. How measurement technology operates in this industrial area on specific process variables such as pressure ,level, flow rate,quantity, temperature is shown. Methods of transmitting data about measurements are presented.

As the author says. " In the days when control mechanism and measurement indication/recording were located close to the operating location in the plant. there was no problem in most cases, but with increase in size and complexity of plant and the consequent centralization of both indication/ recording and control,it became essential to devise a convenient method to transmit measurement data over much greater distances. This need led to the design of the 'transducer' or 'transmitter' in both pneumatic and electronic forms".

The second part of the book surveys the techniques which process plants regulation and control are based on.Several control principles are set out: on/off control action, proportional, integral, derivative control action. the closed loop, causes of delay in process systems, dynamic stability, damping factor, propor tional bandwidth, feedforward control, integral saturation, manual control and " bumpless transfer", external reset, discrete control actions, direct digital control.Final control elements are also presented. In the author's opinion "the final control element is in some ways the most important part of the control system... it is often given too little attention,with the result that the control system performs very badly".

As principles underlying the control system design, process flow diagrams,instrument diagrams, other drawing methods. controllability, dynamic non-linearity, observability, instability, rangeability are taken into consideration.

It is chapters of the third part that get readers familiar with "how these microprocessor-based equipment system function and how they are constructed from

the standard components available in 'chip' form". The advent of VLSI circuitry has made it possible that the former direct digital control systems which employed a single monolithic computer are superseded by distributed microprocessor systems. The principles of data processing, the components of a microprocessor system (buses,processor chip, memory chips, i/o port, serial i/o interfacing,i/o control strategies, direct memory access), and data acquisition sub-systems (signal multiplexer, analog-to-digital conversion, sample and bold circuitry) are in turn outlined.

Subjects capturing readers' attention to a large extent such as data transfer between sub-systems,from basic principles to message packaging and protocols, are also covered in this part of the book.

The last part deals with the implementation of microprocessor-based measurement and control systems.

A distributed control system is discussed in all its aspects: data highways, system architecture, data gathering units, closed-loop control units, operator interface, historical data, computer interfacing, alarm monitoring, redundancy, fault-monitoring and maintainability. Some very interesting subjects related with microprocessors at the closed-loop level are also approached. Among them there are intelligent transducers, controllers, final control elements, sequence control, self-tuning controllers, software downloading.

Advanced control techniques and emergency shut-down systems are not overlooked, as expert systems are not overlooked either.All these are reserved the concluding chapter of the book.

System approach progress towards experience and a complete overview of all essential aspects make the volume be a valuable contribution to the field of microprocessors.

Pierre Radulescu