IMPACT OF RECENT COMPUTER TECHNOLOGY ON SYSTEMS CONTROL

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1. INTRODUCTION

It is oftentimes said that systems control requires three C's, namely, Computer, Communication, and Control technology. The present report is aimed at providing the reader with an overview of the roles of computer technology in today's systems control. The activities of any enterprise may be broken down into three phases: planning, execution, and evaluation phases, or, in short, "plan", "do" and "see" phases. The planning phase involves activities such as system design, production planning, and line scheduling. The second phase, the execution or "do" stage, is actuation, i.e., actual execution of control actions. The third phase consists of such activities as testing of finished products, evaluation of overall performance of production lines, and detection of defects or anomalies. Until the middle of 1970's, most computer applications in systems control had been centered around the
second phase. The last several years have witnessed marked changes in the modes and fields of computer application. Today, a wide variety of computers and microprocessor-imbedded devices are found not only in the second phase but also in the first and the third phase.

Several reasons may be pointed out for this change. The first and obvious reason is, needless to say, the marked breakthrough of microelectronics technology, which has given rise to inexpensive yet very powerful 16-bit and 32-bit microprocessors. Today's high-end off-the-shelf 16-bit microprocessors are cheaper than ten-turn potentiometers yet they are by far more powerful than minicomputers of the early 70's with a price tag of over ten thousand dollars. Secondly, computer applications have expanded to other industrial fields than process industries such as machining and assembly automation, where discrete materials are processed and handled. This change is, among other things, due to the development of Computer Aided Technologies such as CAD, CAM, CAT and CAE. Lastly but by no means least importantly, the development of communications among computers, process equipments and human operators has contributed to the establishment of an integrated information network by which the three phases mentioned before can be combined functionally for total optimization.

In the first place, the present report reviews the historical development of computer applications in systems control, with particular emphasis placed on the use of computer aided technologies in the planning and evaluation phases. An overview of the present status and future prospects of computers and related technologies is then given. This is followed by the description of some salient examples of recent computer technologies such as image processing, machine diagnosis and knowledge engineering.

2. FROM PROCESS AUTOMATION TO COMPUTER INTEGRATED MANUFACTURING

The last decade has witnessed a dramatic leap in VLSI technology, which has given rise to high-performance superminis, minis and micros. The development of communication technology has provided the system designer with a tool to tie together a wide variety of computers distributedly located. The popularization of modern control theory and artificial intelligence disciplines are changing drastically the philosophy of systems design.