Intelligent Manufacturing: Programming Environments for CIM

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INTELLIGENT MANUFACTURING:

PROGRAMMING ENVIRONMENTS FOR CIM

Edited by

William A. Gruver and J.C. Boudreaux

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Introduction

During the last decade, various programming languages have been proposed for use in factory automation and computer-integrated manufacturing (CIM) systems. Some of these languages already have attained several generations of development, and they now include concepts from knowledge-based systems, discrete event systems and object-oriented programming languages. Building on textual languages developed for industrial robots and numerically controlled machine tools, manufacturing programming environments attempt to provide a common interface to industrial devices and sensors that would otherwise require specialized programming by different people with different levels of skills.

The purpose of this book is to provide an exposition of the major issues associated with programming environments for manufacturing and to illustrate specific software systems developed for industrial application. This book is intended for electrical and mechanical engineers, computer scientists, research and development personnel, and design and manufacturing engineers interested in computer integration of manufacturing systems. Familiarity with modern programming languages, such as C++ and Common LISP, will increase the reader's appreciation of the contents. The reader of this book will gain an understanding of the "state of the art" and recent trends in manufacturing languages and programming environments, and better understand how they can be used to integrate computer-controlled machines and intelligent sensors in automated manufacturing systems including machine tools, robots, and inspection and material handling equipment. References at the end of each chapter point to additional reading.

The motivation for this book resulted from a satellite teleconference that was broadcast throughout the USA over the National Technological University Network in Summer 1990 from the University of Kentucky and organized by the editors. This event was followed by an invited session "Programming Environments in Manufacturing Systems" at the 1991 IEEE International Conference on Robotics and Automation, held in Sacramento, California.

The book is organized as follows. The first two chapters describe an architecture for developing manufacturing control software and a specific programming language environment for computer integration of manufacturing systems. The next two chapters contain an exposition of issues underlying programming environments for manu-

facturing and examples drawn from specific programming language environments that were developed for industrial application with emphasis on the object-oriented paradigm. The next three chapters cover iconic programming environments incorporating discrete event systems, Petri nets, graphical languages and model-based systems. The book concludes with four chapters covering related methodologies and tools emphasizing database organization for concurrent engineering, knowledge-based systems for diagnosis of automated manufacturing systems, the organization of pictorial information in manufacturing systems, and CIM communication networks and protocols.