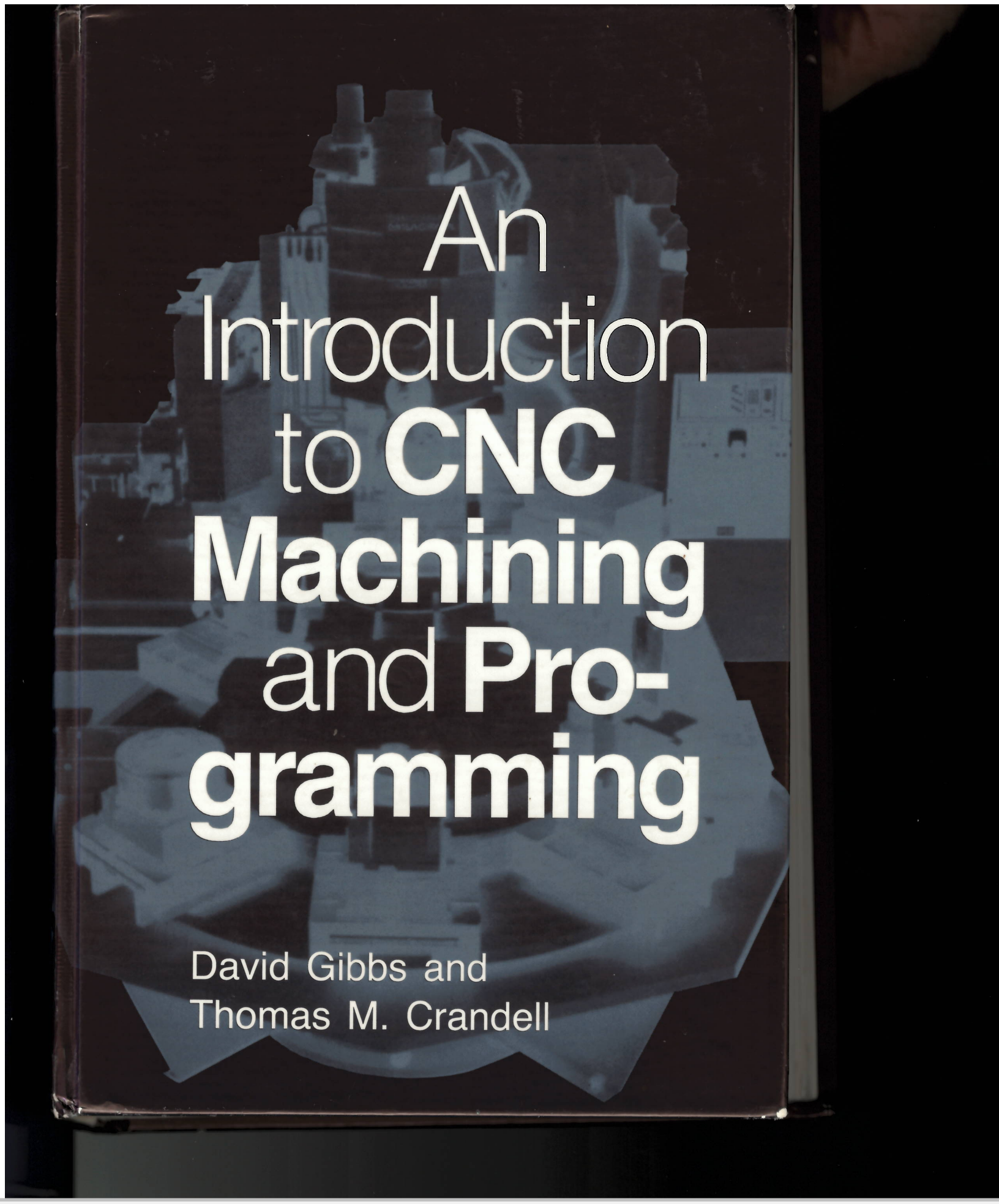

An Introduction T

CNC Machin and Programmi

David Gibbs
I. Eng., MIED
Senior Lecturer in the Department of T
Reading College of Technolo
England

Thomas M. Cran
Computer Integrated Manufacturing C
Associate Professor
Manufacturing Engineering Technologie
Ferris State University

Industrial Press In

DEDICATION

I would like to dedicate my work on this textbook in loving memory of my grandfather, Edgar L. Crandell. I also dedicate my work to my parents Gale and Beverly Crandell. It was these three individuals who taught me to work hard to complete a task and to do it to the best of my ability. I thank them for their time and patience during my upbringing.

My thanks goes to the following: My family—Linda, Chad, and Todd—for time spent away from them; Ferris State University for equipment support; and Ferris Faculty and Staff that provided assistance.

Thomas M. Crandell

Portions of this text were originally published in Great Britain by Cassell Publishers Limited as *An Introduction to CNC Machining, 2nd edition,* © 1987 by David Gibbs and *CNC Part Programming,* © 1987 by David Gibbs.

Library of Congress Cataloging-in-Publication Data

Gibbs, David.

An introduction to CNC machining and programming/David Gibbs, Thomas M. Crandell.

552 p. 15.6 × 23.5 cm. Includes index. ISBN 0-8311-3009-1

1. Machine-tools—Numerical control—Programming. I. Crandell, Thomas M. II. Title.

TJ1189.G53 1991

621.9′023—dc20 90-23499

CIP

INDUSTRIAL PRESS INC.

200 Madison Avenue

New York, New York 10016-4018

6 8 9 7

CONTEN

PREFAC

An Introduction to CNC Machining and Pr
the essentially practical activity of preparing
control (CNC) part programs for turning, r
value to students in a wide range of course
and calculations of all forms, tooling for CN
in a major or related course in a college, uni

The preparation and proving of CNC par
chinery and computer installations in order
experience. Using such equipment, and unde
languages and techniques, requires instructi
a competent instructor. Students undertaking
programming will therefore find it necessary
college or training center. The student must
basic machining techniques, and should ide
turning, milling, and drilling operations. In
mental requirements have been borne in mi

CNC part programming is an absorbing a
one of the few areas of study where studer
too quickly! Thus a primary objective of t
course time can be used to the best advanta
devote as much time as possible to preparing
equipment. Accordingly, an attempt has be
formation to provide the student with much o
to support the more practical elements of stu
on formal lectures and unnecessary note ta
student with the opportunity to study specif

This text is essentially practical in nature a
material for course work. It contains a seri
student with a practical understanding of C
gramming by various means. Throughout t
detailed drawings of components in inch and
included to complement the text, may also
in the early stages of a course. An additio
degrees of complexity and intended for later
ability.

It is the author's experience that many r

for retraining, also many younger students, are hampered in their programming work by never being taught how to apply their calculation skills in algebra, geometry, and trigonometry. It is generally outside the scope of a course of study devoted to part programming to spend much time rectifying this state of affairs, and yet it cannot be ignored. To assist both instructors and students there is a chapter devoted entirely to the type of calculations that will be encountered when preparing part programs manually; it is hoped that the completion of this material, supported by on-the-spot tutoring by faculty, will be of value.

This text will be of on going value to students, faculty, and industrial programmers alike.

D.A.W. Gibbs
Workingham

Thomas M. Crandell
Ferris State University

1

AN INTRODUCTION TO
OF COMPUTER NUMER

DEFINITION OF NUMERIC

Numerical control (NC) is the term used to
movements and various other functions by ins
numbers and initiated via an electronic contr

Computerized numerical control (CNC) is
system utilizes an internal computer. The inte
lowing: storage of additional programs, progr
from memory, machine and control diagnos
metric–incremental/absolute switchability.

The two systems are shown diagrammatical
may be free-standing or built into the main s
erating panel of an integrated control unit is

THE APPLICATION OF COMPUTER

Computer numerical control is applied to a v
cesses such as metal cutting, woodworking, w
forming, sheet metal punching, water jet cut
ing and laser cutting. The text that follows
common machine-shop engineering processe
drilling, where it has been particularly succe

THE ADVANTAGES OF COMPUTE

Computer numerical control is economical for
single-item production. Many factors contrib
most important of these being as follows:

(a) high productivity rates
(b) uniformity of the product
(c) reduced component rejection

DOCKET ALARM

Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

Real-Time Litigation Alerts

Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

Advanced Docket Research

With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

Analytics At Your Fingertips

Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

LAW FIRMS
Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

FINANCIAL INSTITUTIONS
Litigation and bankruptcy checks for companies and debtors.

E-DISCOVERY AND LEGAL VENDORS
Sync your system to PACER to automate legal marketing.