



# CNC MACHINING Handbook

Building, Programming,  
and Implementation

**ALAN OVERBY**

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Alan Overby received a B.S. in Electrical Engineering from Arizona State University. He has always had a hobbyist interest in CNC technology, and has owned, programmed, and operated several CNC routers and engraving machines on a professional level within the signage industry. Mr. Overby was co-owner of Custom CNC, Inc., a company that provided new and replacement controller systems to both individuals and original equipment manufacturers.

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### CNC Machining Handbook

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## Preface

Using CNC, whether on a professional or hobbyist level, is not only an exciting process to be involved in but is also the direction manufacturing is heading. There are a great many facets and stages involved in the end-to-end process of understanding and implementing CNC, and, although there have been several books published on specific aspects or topics (such as G-code programming, building a CNC machine, etc.), there have been no books written that guide the reader through the overall process, that is, until now. It is not the intent of this book to replace any previously written information on this topic nor to delve into any particular area. However, by the time readers finish reading this book, they will have a solid understanding of the entire CNC process from a top-down end-to-end perspective.

More specifically, this book is intended for the following audiences:

- *Academic:* This book will provide the instructor and students a very informative introduction into applied CNC, the various machines, and their uses, along with the necessary tools used in the process.
- *Business owner:* The aspect of moving a small- to medium-sized business, or even a startup company, from a manually concentric manufacturing process into the accuracy and repeatability of what CNC has to offer, can be a daunting task. This book guides business owners in the proper direction to help them understand and decide the ins and outs of automating their manufacturing process. Furthermore, also discussed will be what to look forward to when growing future CNC-based operations.
- *Hobbyist:* There are a great number of individuals interested in the understanding and technical aspects of CNC, but are not exactly sure where to begin—what is absolutely required for the application at hand from both a hardware and software perspective and what is not. There are many free and low-cost software options to choose from that are listed for the reader to appropriately determine what is needed for their particular application.

- *Readers looking for an industry guide:* This book is also intended to be used as a guide, showing the reader that there are certain industry standards within the field of CNC that should be adhered to. There are proprietary hardware and software systems for sale and this book advises the reader as to the pitfalls of using components and systems that are nonstandard. Furthermore, the reader is armed with the appropriate questions to ask the vendors when trying to determine the best approach to take.

Depending on who the reader has previously spoken with or what information they have read, this book will help to augment or clarify what is truly needed for your particular application. This information is to help arm you with the proper information rather than leaving you to rely on what a salesperson is interested in selling you. Often there are low-cost and even free software tools available. These will help you make the determination if certain hardware or software will satisfy your needs, before spending money where you may not need to.

I believe a picture is worth a thousand words. Therefore, I have made every attempt to incorporate illustrations to help the reader visualize what the part looks like and to give an example for reference. Obviously, it would be impossible to include individual pictures of each type of a component, but the main concept is conveyed to the reader with what has been included.

This book also has the following intentions:

- To simplify or demystify CNC for the reader. Where applicable, the intention is to provide the reader with an easy-to-understand, sensible, and logical order of operations.
- To list various hardware and software that I have either previously used with great success or that have been used by companies that have good reputations within the industry.
- To explain in detail the steps and operations used during CAM operations.
- To provide a listing and overview of the commands used in the G-code language.
- To list informative CNC-based Web sites, forums, and additional publications where the reader can obtain more in-depth information on topics covered here.

What I recommend you do as you are reading through this material is to use a highlighter to help you denote the specific items that you find key to understanding the CNC concepts. More importantly, you should keep a steno pad or notebook somewhere close by your computer workstation and CNC machine. Start compiling your own listing of good, known values you

