

Preface

In 1992, Jonathan Mills announced the availability of Stiquito, a “small, inexpensive, hexapod robot.” For \$10 you could order from Indiana University a kit to build this small robot. Jonathan did not envision the number of requests he would receive, which by 1996 had reached more than 3,000. The volume of orders strained his personal ability to fulfill them; he started searching for alternate suppliers for the robot but had little success. In 1996, Jonathan was still receiving orders for Stiquito, although he had announced that Indiana University was no longer offering the kits.

In the summer of 1993 Jonathan began work on a research-oriented Stiquito book. In August 1994, I joined Jonathan in the effort to prepare and organize the chapters and identify other additional material that would be valuable in the book. By the fall of 1995, our publisher suggested that the original book be split into two books. The first book, *Stiquito: Advanced Experiments with a Simple and Inexpensive Robot*, was released in November 1997.

This second book is more educationally oriented than the first. This book has chapters more suited for high school and undergraduate students. It has the supplies needed to build one Stiquito robot. It also has an online teacher’s manual, which includes additional experiments and lists the science benchmarks and national standards associated with each chapter and experiment. A solutions manual is also available from the publisher.

Stiquito for Beginners: An Introduction to Robotics can be used as the only book for an entire course, but it is best suited as one of several sources of material for a course. An early version of this book was used in an Introduction to Engineering Design and Skills course at North Carolina State University. It has been extensively reviewed by high school educators and university science education faculty.

This book is organized in three major parts: introductory material (Chapters 1–4), assembly instructions (Chapters 5–8), and summary and references (Chapter 9 and appendices). The specific topics of each chapter include:

- Chapter 1: An Introduction to Robotics and Stiquito—This chapter presents a brief overview of robotics and describes the Stiquito robot. This chapter also describes the skills needed to build a Stiquito robot.
- Chapter 2: Engineering Skills and the Design Process—What is an engineer? What skills does an engineer need? How does an engineer go about designing something? This chapter explores these questions.

- Chapter 3: Electricity Basics—This chapter discusses some of the basic properties of electricity and provides some experiments to show how electricity and electronic components work.
- Chapter 4: Nitinol Basics—This chapter discusses some of the basic properties of the Stiquito’s muscle, nitinol wire. This chapter also provides some experiments to show how electricity and nitinol work.
- Chapter 5: Stiquito: A Small, Simple, Inexpensive Hexapod Robot—This chapter gives step-by-step instructions on how to assemble the robot kit included in the book.
- Chapter 6: A Manual Controller for the Stiquito Robot—You have finished building the robot kit. Now how do you make it walk? This chapter gives step-by-step instructions on how to build the simplest tethered controller for Stiquito.
- Chapter 7: A PC-Based Controller for the Stiquito Robot—This interface allows you to use an IBM PC or compatible computer to control the actuators on the Stiquito robot and experiment with various gaits.
- Chapter 8: A Simple Circuit to Make Stiquito Walk on Its Own—This chapter contains detailed instructions on how to build an electrical controller to allow Stiquito to walk autonomously.
- Chapter 9: The Future of Stiquito and Walking Robots—Now that you have built Stiquito, what can you do with it? What can it be used for in the future? This chapter explores these questions.
- A biography, a list of suppliers, and an index are also included.

How you use this book depends entirely on the course and time allocated for course material. Our suggestions are below. Refer to the Instructors Manual on the IEEE CS Press Stiquito web pages (<http://www.computer.org/books/stiquito>) for additional materials and suggestions:

- For an Introduction to Engineering course, follow this book sequentially. You will want to augment this book with other materials.
- For an electronics course, cover Chapters 3 (if needed), 5, 7, and 8 sequentially.
- For a robotics course (or to cover robotics within a course), use Chapters 1, and 3–9 sequentially.

As usual, we always recommend reading Chapter 5 before attempting to build the Stiquito Robot. If you read Chapter 5 completely before you build Stiquito, you will save time by avoiding common mistakes that everybody makes when trying to assemble the robot too hastily. You will also avoid wasting materials in your kit because of errors that the instructions can help you prevent.

Jonathan and I would like to thank the many people who assisted in the development of this book. Jon Butler, a volunteer of the IEEE Computer Society, provided continuous encouragement to Jonathan to create this book. Matt Loeb, Tom Fink, and Denise Hurst of IEEE Computer Society Press were instrumental in bringing this book to the marketplace. Ken Gracey of Parallax and Jon Pedersen of East Carolina University read drafts of the book and offered recommendations. Jamie Asbury of Hayssen and Bas Evers of Ericsson helped design, lay out, and test prototypes of the circuits and circuit boards described in Chapters 7 and 8. Murali Raju, Serge Caron,

Un Tung, Wesley Hisel, Larry Laxdal, Alexis Desbiens, and Tom Cooper tested the circuit in Chapter 8

Jonathan wishes to thank Indiana University and its Computer Science Department for the facilities they have provided for this project, notable in a liberal arts university that does not have an engineering school. He also wants to recognize his colleagues in the Computer Science Department, especially Steven Johnson and his students for their support and effort that turned Stiquito from what might have been just a toy into an educational and research tool that is in active use today.

I would like to recognize the University of Arkansas, especially my colleagues in the Computer Systems Engineering Department, and Collis Geren, Neil Schmitt, and Susan Vanneman for their support of Stiquito and engineering education. Special thanks go to Fritz Wilson and his team at Motorola University Support for their donation of Motorola semiconductors used in Stiquito education and research.

I also want to recognize my parents, the Conrads, my in-laws, the Warrens, and my children, Jay, Mary Beth, and Caroline, for their constant support during this project. I would especially like to thank my spouse, Stephanie Conrad, for her patience and support, even when deadlines dictated that I spend more time with Stiquito than with her.

James M. Conrad