

Self-Reconfigurable Robots

An Introduction

**Kasper Stoy
David Brandt
David J. Christensen**

**The MIT Press
Cambridge, Massachusetts
London, England**

© 2010 Massachusetts Institute of Technology

All rights reserved. No part of this book may be reproduced in any form by any electronic or mechanical means (including photocopying, recording, or information storage and retrieval) without permission in writing from the publisher.

For information about special quantity discounts, please email special_sales@mitpress.mit.edu

This book was set in Times New Roman on 3B2 by Asco Typesetters, Hong Kong.
Printed and bound in the United States of America.

Library of Congress Cataloging-in-Publication Data

Stoy, Kasper, 1973–
Self-reconfigurable robots : an introduction / Kasper Stoy, David Brandt, and David J. Christensen.
p. cm. — (Intelligent robotics and autonomous agents series)
Includes bibliographical references and index.
ISBN 978-0-262-01371-0 (hardcover : alk. paper) 1. Robotics. 2. Robots. I. Brandt, David, 1979–
II. Christensen, David J. III. Title.
TJ211.S794 2010
629.8'92—dc22

2009021060

10 9 8 7 6 5 4 3 2 1

Preface

It requires significant amounts of motivation to start writing and later actually complete a book. The motivation for me came from two sources. In my everyday work at the University of Southern Denmark, I spend a large part of my time supervising students on projects related to the topic of this book. It became increasingly frustrating for me to supervise these students because I didn't have any efficient way to communicate the essential knowledge generated in the field of self-reconfigurable robots besides directing them to the rapidly growing number of research papers on the topic, which are now passing the 400 mark. This book is the cure for this frustration. Here I have compiled all the knowledge I find essential to an understanding of the field of self-reconfigurable robots and thus have made it possible for students to access it easily and use it to inform their own work.

The second motivation is a similar concern about the research field as a whole. I find that since in the past it has been so time-consuming to obtain the knowledge contained in this book and the many articles on which it is based, new researchers were prevented from entering the field. If they did, they were at a high risk of reproducing results or using approaches that had become irrelevant. With this book, I hope to open the field to a new generation of researchers and at the same time jump-start their research efforts.

In this book I focus on the intuition behind self-reconfigurable robots and their control rather than the technical details. However, for the discussion of self-reconfiguration as search, some basic knowledge of search algorithms is assumed. The advantage of leaving out some technical details is that it makes the book accessible to a wider audience, but it also means that the reader sometimes has to be referred to the material on which it is based in order to obtain the technical details needed for implementation. The book is also written from a practical, engineering perspective. The idea behind this is that the reader should be compelled to put the book down and start contributing to the field of self-reconfigurable robots as fast as possible.

This book is of course subjective and as a result, other researchers may have different perspectives or would have chosen to include other references. I therefore apologize for any I have left out and recommend that researchers with different perspectives write another book!

Finally, I would like to thank the people who made this book possible. First of all thanks to the group of people with whom I have spent countless number of coffee breaks discussing the finer points of self-reconfigurable robots, two of whom also co-authored this book: David Brandt and David J. Christensen. I would also like to thank the broader group of people who participated in the European Union project HYDRA, which essentially got research on self-reconfigurable robot started in Europe; in particular I want to thank the people responsible for starting it: Henrik Hautop Lund, John Hallam, and Rolf Pfeifer. I also want to thank Wei-Min Shen from the University of Southern California's Information Sciences Institute, who introduced me to the field. Finally, I would like to thank my wonderful wife for providing endless support during the more agonizing periods of writing and for insisting on working in Cambodia and thereby giving me an excuse to take the sabbatical that allowed me to write this book.