The Knowledge Engineering Review, Vol. 22:2, 209–211.
Printed in the United Kingdom

Book Reviews

Models of a Man: Essays in Memory of Herbert A. Simon by Mie Augier and James G. March, MIT Press, 553 pp., $45.00, ISBN 0-262-01208-1
doi:10.1017/S0269888907228012

This is a book that, as the saying goes 'does exactly what it says on the tin'. It is a book of essays — well, forty-one essays and one poem — written as a eulogy, a remembrance, and a reminder of the life and work of Herbert Simon. It is a fascinating and varied collection.

In the Preface, the editors explain that they asked contributors to identify the paper or book of Simon's that most influenced them, and they structure the book around this facet of the essays, grouping essays that refer to the same or similar work together in the same part of the book. Those contributors who stuck closely to this requirement generated the kind of essays that one might expect to find in a festschrift, and there is nothing wrong with that. Simon was, of course, someone who made deep contributions to a much wider range of disciplines than most of us even get to study to any significant depth. As a result, the authors of the essays in *Models of a Man* are some of the most respected figures in that same wide range of disciplines, and they are models of their type — clear, concise and illuminating. However, it is the contributors who did not follow the instructions who give us, in my view, something that is much more valuable.

What they give us, these contributors who were unable, or unwilling, to follow this standardized approach, are the best models of the man. These are the essays by Simon's close colleagues and friends (and there is even an essay by his eldest daughter), essays that not only celebrate his academic achievements, but also show how these fitted into his life. Here, amongst the reminiscences of ex-students and friends, one can get a glimpse of the life of a great scholar, a very engaging human being and a man who will be greatly missed by a large number of people. Putting the pieces together, one can build up a very inspiring view, a view of a man who, not only made great contributions to his chosen fields, but also found the time to spend with his family, on good conversation, and in discussion with his students. This composite picture, it seems to me, is not just a model of Herbert Simon, but a model of what it means to be a scholar, and it is as a model for those of us who also seek to be counted as scholars that he may be missed the most.

Reviewed by Simon Parsons
Brooklyn College, City University of New York, USA

Principles of Robot Motion: Theory, Algorithms and Implementations by Howie Choset, Kevin M. Lynch, Seth Hutchinson, George Kantor, Wolfram Burgard, Lydia E. Kavraki and Sebastian Thrun, 603 pp., $60.00, ISBN 0-262-03327-5
doi:10.1017/S0269888907218016

The field of robotics is burgeoning. Indeed, it sometimes seems that there are robots wherever one looks — Lego robots being used to teach science in school classrooms, robot vacuum cleaners being used to keep homes clean, and search and rescue robots being used to survey hurricane-damaged buildings are just the most obvious examples. As one might expect, this growth is reflected in the research literature, which is now vast, and in the technical achievements, which are truly impressive — for example, the ability to navigate autonomously for more than a

hundred miles through the desert. All of this growth, however, has a flip-side. It is now extremely difficult for a novice to navigate through the primary literature, to find the key results, and to appreciate the technical underpinnings of the field. Although several good textbooks have been published in the last few years, for example, Bekey (2005) and Siegwart & Nourbakhsh (2004), and some fine books on specific aspects of robotics, such as Thrun *et al*. (2005), there has not been a comprehensive source. This gap is now, to most intents and purposes, filled by *Principles of Robot Motion*.

Of course, as its title suggests, *Principles of Robot Motion* neither covers all of robotics, nor does it pretend to. Its somewhat more modest aim is to provide a treatment of the fundamental ideas in *motion planning*, that is, the part of robotics in which we are concerned with moving through space. Thus the book is not concerned with, for example, topics such as robot vision, or the problems of designing interfaces by which humans can easily control robots. This is, to my mind, perfectly reasonable both because it means that the book manages to be wieldy, and because I find the topics that the book does cover to be the most interesting branches of robotics.

Within the area of motion planning, the coverage is pretty comprehensive, and exactly what one would expect given the title, provided that one interprets the title in the right way. In particular, the term 'principles' means 'theoretical foundations of' and the term 'robot motion' means 'everything that is necessary to program a robot that moves'. In other words, *Principles of Robot Motion* covers all of the mathematics that one has to understand to write programs to control robots that move through the world. It neither talks about hardware, nor covers anything that is cognitively more complex than planning how to move through space (so there is nothing, for example, on how to break a task down into its components or how to get a team of robots to cooperate in mapping a room), but in the space between those limits *Principles of Robot Motion* provides all that one might hope for.

To be more precise, *Principles of Robot Motion* follows the introduction with a chapter (Chapter 2) that covers some very simple algorithms for controlling idealized point-like robots. Since such approaches are obviously not realistic, the book then (Chapter 3) examines how to deal more realistically with the physical dimensions of robots, introducing theory that is used throughout the remainder of the book, before exploring artificial potential fields (Chapter 4) which enable a family of simple control algorithms to guide a robot through a space. Since such algorithms are not foolproof, the text turns (Chapter 5) to considering *roadmap* techniques, and the cell decomposition methods (Chapter 6) that can be used to create maps of a robot's world. The next topic (Chapter 7) is the use of sampling algorithms that can speed up the work of the planner. This completes what one might consider to be the first section of the book[1], concerned with planning paths that a robot, whether a mobile robot or a manipulator, should take.

This first section, though it is realistic in its handling of robot dimensions, rather fudges some of the important issues that one faces in programming robots, in particular the problems of the uncertain response of sensors, and the consequent errors that arise in deciding where a robot is (which will be a problem in trying to execute one of the paths that the path planners generate). The second section of the book (Chapters 8 and 9) deals with these issues, providing probabilistic techniques for localization and mapping (including simultaneous localization and mapping). This is material that will be familiar to anyone who has read Thrun *et al*. (2005), but is none the worse for that.

The cumulative effect of the first two sections of *Principles of Robot Motion*, then, is to provide the tools to plan a path through a space, and then track progress along the path. However, even when we explicitly take account of the sensor uncertainty, the paths that are planned are making a big asusmption — that robots can instantaneously change their velocity — which will not be true of any real robot. Sometimes this assumption will not be important, but in the general case we need to deal not only with path planning, but also with *trajectory planning*, and this is the topic

[1] The book is not formally broken up into sections, but this thematic grouping of chapters seems quite natural.

of the third section of the book. First (Chapter 10), it provides the necessary background on robot dynamics before looking at how to control robots that have one actuator for each degree of freedom (Chapter 11) and then robots that are underactuated (Chapter 12).

In addition to its wonderful coverage, it is worth noting that *Principles of Robot Motion* is very well written, and very uniform in style for a book with seven co-authors. The only variation that I noticed was in the provision of detailed algorithms (as in pseudocode rather than textual descriptions) — some chapters have many, while others have none — and a lack of some obvious cross referencing where the same topic is touched on in different chapters. However, these are minor flaws, and do not detract much from the overall excellence of the book.

Reviewed by Simon Parsons
Brooklyn College, City University of New York, USA

References

Bekey, GA, 2005, *Autonomous Robots: From Biological Inspiration to Implmentation and Control*. Cambridge, MA: MIT Press.

Siegwart, R and Nourbakhsh, IR, 2004, *Introduction to Autonomous Mobile Robots*. Cambridge, MA: MIT Press.

Thrun, S, Burgard, W, and Fox, D, 2005, *Probabilistic Robotics*. Cambridge, MA: MIT Press.