

Intelligent Systems, Control and Automation: Science and Engineering

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Fernando Auat · Pablo Prieto · Gualtiero Fantoni
Editors

Rapid Roboting

Recent Advances on 3D Printers and Robotics

 Springer

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Preface

Everyone needs time. Everyone likes to make things quickly, like the chef in a restaurant trying to organise all the preparations on a busy day. Everyone wants to have a detailed recipe for producing items efficiently and faster without losing quality, like the businessman. Everyone likes to be a pioneer in their field of expertise, like researchers working in a lab. But time is a killer. Everyone needs time.

This book aims to introduce the novel concept of Rapid Roboting, an analogy to the original idea of Rapid Prototyping, which was related to the quick building of prototype parts by machines reading data from a computer. Rapid Roboting is then the fast development of robots prototypes. The harmonical use of three enabling technologies supports this novel concept: Modular Open **Electronic** Hardware, Light **Programming** Languages and Additive **Manufacturing** in the context of robotics. By integrating those different technologies harmonically, it is possible to speed up the design process of robots, especially when testing new ideas on research or developing new robots for specific commercial purposes. When trying new concepts in robotics at the beginning of the design process, developing prototypes is an essential task for moving from the initial tests to more elaborated final prototypes. At this early stage, open-source electronics and light programming languages are convenient for speeding up the entire process. This book introduces Additive Manufacturing techniques and gives implemented examples of projects and research of the Rapid Roboting concept.

The audience can be university-level students interested in developing robots, researchers in computer science, mechatronics, electronics, small companies or start-up developing robotic applications or, in general, everyone interested in developing new robotic applications, having basic knowledge in the area.

This book is not for people interested in learning robotics from the beginning. It is a book for those who have already started the fantastic journey of changing the world by developing new robots. The book was a collaborative work of the editors and contributors from different institutions, research areas and countries, looking to the future and shaping it by developing new robotic applications. Before starting

with the book, the editors would like to give special thanks to Michelle Viscaino for her valuable help in achieving this challenge.

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Pisa, Italy

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Acronyms

AANN	Adaptive artificial neural networks
ABS	Acrylonitrile butadiene styrene
AI	Artificial intelligence
AM	Additive manufacturing
ANN	Artificial neural networks
ASTM	American Society for Testing and Materials
CAD	Computer-aided design
CAM	Computer-aided manufacturing
CLI	Command line interface
CNC	Computer numerical control
COM	Centre of mass
CPPN	Compositional pattern producing network
CT	Computed tomography
DARPA	Defense advanced research projects agency
DIY	Do it yourself
DoF	Degrees of freedom
DSP	Digital signal processor
FACE	Facial automation for conveying emotions
FDM	Fusion deposition modelling
FPGA	Field programming gate array
GOFAI	Good old-fashioned artificial intelligence
GP	Globus pallidus
GUI	Graphical user interface
HMI	Human-machine interface
IoT	Internet of Things
LGN	Lateral geniculate nucleus
LPL	Liht programming languages
MCU	Microcontroller unit
MODI	MODular intelligence
MOEH	Modular open electronic hardware
mPFC	Medial pre-frontal cortex

MPU	Microprocessor unit
MT	Manufacturing technologies
NEAT	Neuroevolution of augmenting topologies
OFC	Orbitofrontal cortex
PFC	Pre-frontal cortex
PLA	Polylactic acid
RAM	Random access memory
RGC	Retinal ganglion cell
ROS	Robot operating system
RP	Rapid prototyping
RTK	Real-time kinematics
SDM	Shape deposition manufacturing
SLA	Stereolithography
SLS	Selective laser sintering
SMS	Social meta scenes
SN	Substantia nigra
STN	Subthalamic nucleus
TRL	Technology readiness level
UV	Ultra-violet
YARP	Yet another robot platform