

Second Edition

# spin dynamics

**Basics of Nuclear  
Magnetic Resonance**

**Malcolm H. Levitt**

 **WILEY**

# **Spin Dynamics**

Basics of Nuclear Magnetic Resonance

Second edition

**Malcolm H. Levitt**  
*The University of Southampton, UK*



John Wiley & Sons, Ltd



# **Spin Dynamics**

Second Edition



# **Spin Dynamics**

Basics of Nuclear Magnetic Resonance

Second edition

**Malcolm H. Levitt**  
*The University of Southampton, UK*



John Wiley & Sons, Ltd

Copyright © 2008

John Wiley & Sons Ltd  
The Atrium, Southern Gate  
Chichester,  
West Sussex PO19 8SQ, England  
Telephone (+44) 1243 779777

Email (for orders and customer service enquiries): [cs-books@wiley.co.uk](mailto:cs-books@wiley.co.uk)

Visit our Home Page on [www.wileyeurope.com](http://www.wileyeurope.com) or [www.wiley.com](http://www.wiley.com)

All Rights Reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, scanning or otherwise, except under the terms of the Copyright, Designs and Patents Act 1988 or under the terms of a licence issued by the Copyright Licensing Agency Ltd, 90 Tottenham Court Road, London W1T 4LP, UK, without the permission in writing of the Publisher. Requests to the Publisher should be addressed to the Permissions Department, John Wiley & Sons Ltd, The Atrium, Southern Gate, Chichester, West Sussex PO19 8SQ, England, or emailed to [permreq@wiley.co.uk](mailto:permreq@wiley.co.uk), or faxed to (+44) 1243 770620.

Designations used by companies to distinguish their products are often claimed as trademarks. All brand names and product names used in this book are trade names, service marks, trademarks or registered trademarks of their respective owners. The Publisher is not associated with any product or vendor mentioned in this book.

This publication is designed to provide accurate and authoritative information in regard to the subject matter covered. It is sold on the understanding that the Publisher is not engaged in rendering professional services. If professional advice or other expert assistance is required, the services of a competent professional should be sought.

#### ***Other Wiley Editorial Offices***

John Wiley & Sons Inc., 111 River Street, Hoboken, NJ 07030, USA

Jossey-Bass, 989 Market Street, San Francisco, CA 94103-1741, USA

Wiley-VCH Verlag GmbH, Boschstr. 12, D-69469 Weinheim, Germany

John Wiley & Sons Australia Ltd, 42 McDougall Street Milton, Queensland 4064, Australia

John Wiley & Sons (Asia) Pte Ltd, 2 Clementi Loop #02-01, Jin Xing Distripark, Singapore 129809

John Wiley & Sons Canada Ltd, 6045 Freemont Blvd, Mississauga, Ontario, L5R 4J3, Canada

Wiley also publishes its books in a variety of electronic formats. Some content that appears in print may not be available in electronic books.

#### ***Library of Congress Cataloging-in-Publication Data***

Levitt, Malcolm H.

Spin dynamics : basics of nuclear magnetic resonance / Malcolm H. Levitt.  
– 2nd ed.

p. cm.

Includes bibliographical references.

ISBN 978-0-470-51118-3 (hb : acid-free paper) – ISBN 978-0-470-51117-6

(pbk : acid-free paper)

1. Nuclear spin. 2. Nuclear magnetic resonance. I. Title.

QC793.3.S6L47 2007

538'.362–dc22

2007022146

#### ***British Library Cataloguing in Publication Data***

A catalogue record for this book is available from the British Library

ISBN 9780470511183 HB

9780470511176 PB

Typeset in 9.5/11.5 Palatino Roman by Thomson Digital, Noida, India

Printed and bound in Great Britain by Antony Rowe Ltd, Chippenham, Wiltshire

This book is printed on acid-free paper responsibly manufactured from sustainable forestry in which at least two trees are planted for each one used for paper production.

*To my mother and father*



