

## Alan Turing—His Work and Impact (II)



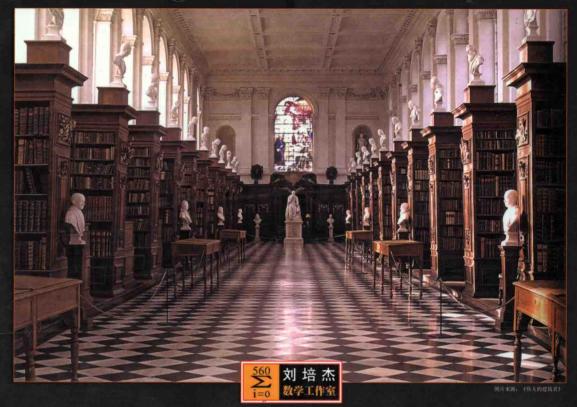
# 艾伦·图灵——他的工作与影响(下)







### Alan Turing-His Work and Impact (II)



### **國外优秀數学著作原版系列(第一辑)**

- zeta 函数,q-zeta 函数,相伴级数与积分
- 微分形式: 理论与练习
- 离散与微分包含的逼近和优化
- 艾伦・图灵——他的工作与影响
- 测度理论概率导论(第2版)
- 带有潜在故障恢复系统的半马尔柯夫模型控制
- 数学分析原理
- 随机偏微分方程的有效动力学
- 图的谱半径

策划编辑 刘培杰 责任编辑 张永芹 杜莹雪 聂兆慈 封面设计 孙茵艾





#### 培杰数学国际文化传播中心

www.impj.cn

刘培杰数学工作室网站 http://lpj.hit.edu.cn

哈尔滨工业大学出版社 **刘培杰数学工作室** 联系地址:哈尔滨市南岗区复华四道街10号

邮 编: 150006

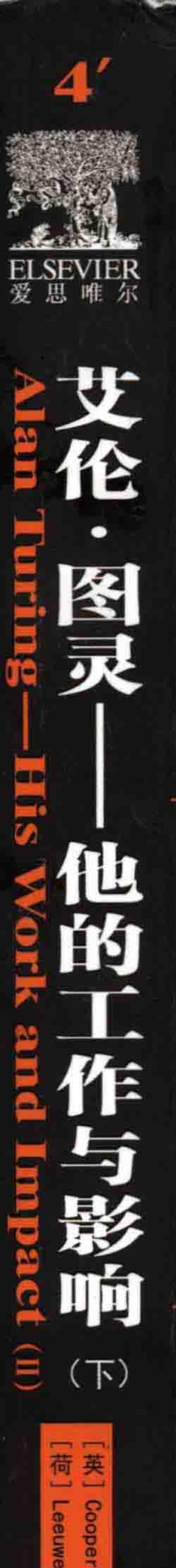
联系电话: 0451-86281378 13904613167

- mail: lpj1378@163.com

微 信: impjpp



定价 98.00元(上、下)



MSHILL SHIP TECHNOLOGY PRESS

eeuwen.



国外优秀数学著作 版 列 原 系

-His Work and I

[英]Cooper, S. B.(库珀)[荷] Leeuwen, J. V.(莱文)

著

(下)

HARBIN INSTITUTE OF TECHNOLOGY PRESS

#### 黑版贸审字 08-2015-063 号

Alan Turing: His Work and Impact S. Barry Cooper, Jan van Leeuwen

ISBN:9780123869807

Copyright © 2013 Elsevier Inc. All rights reserved.

Authorized English language reprint edition published by Elsevier (Singapore) Pte Ltd. and Harbin Institute of Technology Press

Copyright © 2016 by Elsevier (Singapore) Pte Ltd. All rights reserved.

Elsevier (Singapore) Pte Ltd.

3 Killiney Road, #08-01 Winsland House I, Singapore 239519

Tel: (65)6349-0200

Fax: (65) 6733-1817

First Published 2016

2016 年初版

Printed in China by Harbin Institute of Technology Press under special arrangement with Elsevier (Singapore) Pte Ltd. This edition is authorized for sale in China only, excluding Hong Kong SAR, Macao SAR and Taiwan. Unauthorized export of this edition is a violation of the Copyright Act. Violation of this Law is subject to Civil and Criminal Penalties.

本书英文影印版由 Elsevier (Singapore) Pte Ltd. 授权哈尔滨工业大学出版社在中国大陆境内独家发行。本版仅限在中国境内(不包括香港、澳门以及台湾)出版及标价销售。未经许可之出口,视为违反著作权法,将受民事及刑事法律之制裁。

本书封底贴有 Elsevier 防伪标签,无标签者不得销售。

#### 图书在版编目(CIP)数据

艾伦・图灵:他的工作与影响:全2 册:英文/(英)库珀(Cooper, S. B.),(荷)莱文(Leeuwen, J. V.)著. —哈尔滨:哈尔滨工业大学出版社,2016.1

书名原文: Alan Turing: His Work and Impact

ISBN 978 - 7 - 5603 - 5766 - 9

I.①艾··· Ⅱ.①库···②莱··· Ⅲ.①图灵, A. M. (1912~1954)-生平事迹-英文②计算机科学-技术史-世界-英文 Ⅳ.①K835.616.11②TP3-091

中国版本图书馆 CIP 数据核字(2015)第 294522 号

策划编辑 刘培杰

责任编辑 张永芹 杜莹雪 聂兆慈

封面设计 孙茵艾

出版发行 哈尔滨工业大学出版社

社 址 哈尔滨市南岗区复华四道街 10号 邮编 150006

传 真 0451-86414749

网 址 http://hitpress. hit. edu. cn

印 刷 哈尔滨市工大节能印刷厂

开 本 880mm×1230mm 1/16 印张 29 字数 781 千字

版 次 2016年1月第1版 2016年1月第1次印刷

书 号 ISBN 978-7-5603-5766-9

定 价 98.00 元(上、下)

(如因印装质量问题影响阅读,我社负责调换)

## **Contents**

Part I	Part I How Do We Compute? What Can We Prove?	
1955	Alan Mathison Turing by Max Newman (Bibliographic Memoirs of the Fellows of the Royal Society, 1 (Nov.), 253–263)	
	Andrew Hodges contributes — A Comment on Newman's Biographical Memoir	3
	Biographical Memoir	5
1936–7	On Computable Numbers, with an Application to the Entscheidungsproblem (Proc. Lond. Math. Soc. (2) 42, 230–265)	
1937	– A Correction (ibid: <b>43</b> , 544–546)	
	Christos Papadimitriou on — Alan and I	13
	Turing texts	16
	Stephen Wolfram on — The Importance of Universal Computation	44
	Martin Davis illuminates — Three Proofs of the Unsolvability of the Entscheidungsproblem	49
	Samson Abramsky detects — Two Puzzles About Computation	53
	Paul Vitányi illustrates the importance of — Turing Machines and Understanding Computational Complexity	57
	Gregory Chaitin traces the path — From the Halting Problem to the Halting Probability	63
	Robert Irving Soare expands on — Turing and the Art of Classical Computability	65
	Rainer Glaschick takes us on a trip back to — Turing Machines in Münster	71

	Reflections on Wittgenstein's Debates with Turing during his  Lectures on the Foundations of Mathematics	77
	Jan van Leeuwen and Jiří Wiedermann on — The Computational Power of Turing's Non-Terminating Circular a-Machines	80
	Meurig Beynon puts an empirical slant on — Turing's Approach to Modelling States of Mind	85
	Henk Barendregt and Antonio Raffone explore — Conscious Cognition as a Discrete, Deterministic and Universal Turing Machine Process	92
	Aaron Sloman develops a distinctive view of — Virtual Machinery and Evolution of Mind (Part 1)	97
	Artur Ekert on the physical reality of — $\sqrt{NOT}$	102
	Cristian Calude, Ludwig Staiger and Michael Stay on — Halting and Non-Halting Turing Computations	105
	Philip Welch leads us — Toward the Unknown Region: On Computing Infinite Numbers	109
1937	On Computable Numbers, with an Application to the Entscheidungsproblem by A. M. Turing – Review by: Alonzo Church (J. Symb. Log. 2, 42)	
	Andrew Hodges finds significance in — Church's Review of Computable Numbers	117
1937	Computability and λ-Definability (J. Symb. Log. 2, 153–63)	
	Henk Barendregt, Giulio Manzonetto and Rinus Plasmeijer trace through to today —	101
	The Imperative and Functional Programming Paradigm  Turing text	121 127
1027		
1937	The p-Function in λ-K Conversion (J. Symb. Log. 2, 164)	
	Henk Barendregt and Giulio Manzonetto point out the subtleties of — Turing's Contributions to Lambda Calculus	139
	Turing text	144

Contents		

1939	Systems of Logic Based on Ordinals (Proc. Lond. Math. Soc. (2) 45, 161–228)	
	Solomon Feferman returns to —	
	Turing's Thesis: Ordinal Logics and Oracle Computability	145
	Turing text	151
	Michael Rathjen looks at — Turing's 'Oracle' in Proof Theory	198
	Philip Welch takes a set-theoretical view of — Truth and Turing	202
	Alastair Abbott, Cristian Calude and Karl Svozil describe — A Quantum Random Oracle	206
1948	Practical Forms of Type Theory (J. Symb. Log. 13, 80–94)	
	Some background remarks from Robin Gandy's — Preface	211
	Turing text	213
1942	The use of Dots as Brackets in Church's System (J. Symb. Log. 7, 146–156)	
	Lance Fortnow discovers — Turing's Dots	227
	Turing text	229
1944	The Reform of Mathematical Notation and Phraseology	
	Stephen Wolfram connects — Computation, Mathematical Notation and Linguistics	239
	Turing text	245
	Juliet Floyd explores — Turing, Wittgenstein and Types: Philosophical Aspects of Turing's  'The Reform of Mathematical Notation and Phraseology' (1944–5)	250
	The Reform of Mathematical Notation and Thraseology (1944-3)	250
Part I	I Hiding and Unhiding Information: Cryptology, Complexity and Number Theory	255
1935	On the Gaussian error function	
	Sandy L. Zabell delivers an authoritative guide to — Alan Turing and the Central Limit Theorem	257
	Turing's 'Preface' (1935) to 'On the Gaussian error function'	264

1953	Some Calculations of the Riemann Zeta function ( <i>Proc. Lond. Math. Soc.</i> (3) <b>3</b> , 99–117)	
1952–3	On a Theorem of Littlewood	
	Dennis Hejhal and Andrew Odlyzko take an in-depth look at — Alan Turing and the Riemann Zeta Function	265
	And Dennis Hejhal adds — A Few Comments About Turing's Method	279
	Turing text	284
	On a Theorem of Littlewood (S. Skewes and A.M. Turing)	300
1954	Solvable and Unsolvable Problems (Science News 31, 7–23)	
	Gregory Chaitin recommends— Turing's Small Gem	321
	Turing text	322
	Wilfried Sieg focuses on — Normal Forms for Puzzles: A Variant of Turing's Thesis	332
	K. Vela Velupillai connects — Turing on 'Solvable and Unsolvable Problems' and Simon on 'Human Problem Solving'	339
1950	The Word Problem in Semi-Groups with Cancellation (Annals of Mathematics, <b>52</b> (2), 491–505)	
	Gregory Chaitin on — Finding the Halting Problem and the Halting Probability in Traditional Mathematics	343
	While John L. Britton gives us a brief — Introduction to the mathematics	344
	Turing text	345
	On Permutation Groups	
	John Leslie Britton's informative — Introduction	359
	Turing text	360
1948	Rounding-off Errors in Matrix Processes (Ouart, J. Mech. Appl. Math. 1, 287–308)	

Contents

	Lenore Blum brings into view— Alan Turing and the Other Theory of Computation	377
	Turing text	385
	A Note on Normal Numbers	
	Andrew Hodges on an interesting connection between —	
	Computable Numbers and Normal Numbers	403
	Turing text	405
	Verónica Becher takes a closer look at — Turing's Note on Normal Numbers	408
1940	Turing's Treatise on the Enigma (Prof's Book)	
	Frode Weierud on Alan Turing, Dilly Knox, Bayesian statistics, decoding machines and — Prof's Book: Seen in the Light of Cryptologic History	413
	Excerpts from the 'Enigma Paper'	417
		717
	Tony Sale delves into the cryptographic background to — Alan Turing, the Enigma and the Bombe	426
	Klaus Schmeh looks at — Why Turing cracked the Enigma and the Germans did not	432
1944	Speech System 'Delilah' – Report on Progress (A.M. Turing, 6 June, National Archives, box HW 62/6)	
	Andrew Hodges sets the scene for — The Secrets of Hanslope Park 1944–1945	439
	Craig Bauer presents — Alan Turing and Voice Encryption: A Play in Three Acts	442
	John Harper reports on the — Delilah Rebuild Project	451
1949	Checking a Large Routine (Paper, EDSAC Inaugural Conference, 24 June. In: Report of a Conference on High Speed Automatic Calculating Machines, 67–69)	
	Cliff B. Jones gives a modern assessment of — Turing's "Checking a Large Routine"	455
	Turing text	461

1951	Excerpt from: Programmer's Handbook for the Manchester Electronic Computer Mark II	
	Local Programming Methods and Conventions (Paper read at the Inaugural Conference for the Manchester University Computer, July 1951)	
	Toby Howard describes— Turing's Contributions to the Early Manchester Computers	465
	Excerpt from: Programmer's Handbook for the Manchester Electronic Computer Mark II	472
Part I	III Building a Brain: Intelligent Machines, Practice and Theory	479
1.	Turing's Lecture to the London Mathematical Society on 20 February 1947	
	(A more readable guide to the ACE computer than Turing's 1945 ACE report)	
	Anthony Beavers pays homage to — Alan Turing: Mathematical Mechanist	481
	Turing text	486
1948	Intelligent Machinery (Report Written by Alan Turing for the National Physical Laboratory, 1948)	
	Rodney A. Brooks and — The Case for Embodied Intelligence	499
	Turing text	501
	Christof Teuscher proposes — A Modern Perspective on Turing's Unorganised Machines	517
	Nicholas Gessler connects past and future — The Computerman, the Cryptographer and the Physicist	521
	Stephen Wolfram looks to reconcile — Intelligence and the Computational Universe	530
	Paul Smolensky asks a key question — Cognition: Discrete or Continuous Computation?	532
	Tom Vickers recalls — Alan Turing at the NPL 1945–47	539

	Douglas Hofstadter engages with — The Gödel–Turing Threshold and the Human Soul	545
1950	Computing Machinery and Intelligence (Mind, <b>59</b> , 433–460)	
	Gregory Chaitin discovers Alan Turing 'The Good Philosopher' at both sides of — Mechanical Intelligence versus Uncomputable Creativity	551
	Turing text	552
	Daniel Dennett is inspired by — Turing's "Strange Inversion of Reasoning"	569
	Aaron Sloman draws together — Virtual machinery and Evolution of Mind (Part 2)	574
	Mark Bishop examines — The Phenomenal Case of the Turing Test and the Chinese Room	580
	Peter Millican on recognising intelligence and — The Philosophical Significance of the Turing Machine and the Turing Test	587
	Luciano Floridi brings out the value of — The Turing Test and the Method of Levels of Abstraction	601
	Aaron Sloman absolves Turing of — The Mythical Turing Test	606
	David Harel proposes — A Turing-Like Test for Modelling Nature	611
	Huma Shah engages with the realities of — Conversation, Deception and Intelligence: Turing's Question-Answer Game	614
	Kevin Warwick looks forward to — Turing's Future	620
1953	<b>Digital Computers Applied to Games</b> (Bowden, B. V. (Ed.), <i>Faster than Thought</i> . Pitman, London, Chap. 25, 286–310)	
	Alan Slomson introduces — Turing and Chess	623
	Digital Computers Applied to Games	626
	David Levy delves deeper into — Alan Turing on Computer Chess	644

1951	Can Digital Computers Think? (BBC Third Programme radio broadcast (15 May 1951), transcript edited B. J. Copeland)	
	Intelligent Machinery: A Heretical Theory (Lecture given to 51 Society in Manchester (c. 1951), transcript edited B. J. Copeland)	
	Can Automatic Calculating Machines Be Said To Think? (Broadcast discussion, BBC Third Programme (14 and 23 Jan. 1952), transcript edited B. J. Copeland)	
	B. Jack Copeland introduces the transcripts — Turing and the Physics of the Mind	651
	Turing texts	660
	Can Automatic Calculating Machines Be Said To Think? By Alan Turing, Richard Braithwaite, Geoffrey Jefferson, Max Newman	667
	Richard Jozsa takes us forward to —  Quantum Complexity and the Foundations of Computing	677
Part I	V The Mathematics of Emergence: The Mysteries of Morphogenesis	681
1952	The Chemical Basis of Morphogenesis (Phil. Trans. R. Soc. London B 237, 37–72)	
	Peter Saunders introduces — Alan Turing's Work in Biology	683
	And Philip K. Maini wonders at — Turing's Theory of Morphogenesis	684
	Turing text	689
	Henri Berestycki on the visionary power of — Alan Turing and Reaction–Diffusion Equations	723
	Hans Meinhardt focuses on — Travelling Waves and Oscillations Out of Phase: An Almost Forgotten Part of Turing's Paper	733
	Iamas D. Murray on what hannanad	
	James D. Murray on what happened — After Turing – The Birth and Growth of Interdisciplinary Mathematics and Biology	739
	After Turing – The Birth and Growth of Interdisciplinary Mathematics	739 753

	K. Vela Velupillai connects — Four Traditions of Emergence: Morphogenesis, Ulam-von Neumann Cellular Automata, The Fermi-Pasta-Ulam Problem, and	
	British Emergentism	759
	Gregory Chaitin takes the story forward — From Turing to Metabiology and Life as Evolving Software	763
1954	The Morphogen Theory of Phyllotaxis	
	I. Geometrical and Descriptive Phyllotaxis	
	II. Chemical Theory of Morphogenesis	
	III. (Bernard Richards) A Solution of the Morphogenical Equations for the Case of Spherical Symmetry (Prepared after December 1954 by N. E. Hoskin and B. Richards, using manuscripts of Turing and notes from his lectures in Manchester)	
	Bernard Richards recalls Alan Turing and — Radiolaria: The Result of Morphogenesis	765
	The Morphogen Theory of Phyllotaxis	
	Part I. Geometrical and Descriptive Phyllotaxis	773
	Part II. Chemical Theory of Morphogenesis	804
	Part III. A Solution of the Morphogenetical Equations for the Case of Spherical Symmetry	818
	Peter Saunders comments on the background to — Turing's Morphogen Theory of Phyllotaxis	827
	Jonathan Swinton explores further — Turing, Morphogenesis, and Fibonacci Phyllotaxis: Life in Pictures	834
	Aaron Sloman travels forward to — Virtual Machinery and Evolution of Mind (Part 3) Meta-Morphogenesis: Evolution of Information-Processing Machinery	849
	Outline of the Development of the Daisy (Prepared from Turing's notes by P.T. Saunders for the Collected Works and updated by J. Swinton.)	
	Jonathan Swinton's updating of the texts — An Editorial Note	858
	Outline of the Development of the Daisy	860
Afterw	vord	867
Biblio	graphy	877
Index		879

3-1 2 35-12

811 J. 62 (111

. : ' +

a tar

and the co

Part III

Building a Brain:
Intelligent Machines, Practice and Theory

