

COMPLEX ANALYSIS A Modern First Course in Function Theory

Jerry R. Muir, Jr. The University of Scranton

WILEY

Copyright ©2015 by John Wiley & Sons, Inc. All rights reserved

Published by John Wiley & Sons, Inc., Hoboken, New Jersey Published simultaneously in Canada

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 as permitted under Section 107 or 108 of the 1976 United States Copyright Act, without either the prior written permission of the Publisher, or authorization through payment of the appropriate per-copy fee to the Copyright Clearance Center, Inc., 222 Rosewood Drive, Danvers, MA 01923, (978) 750-8400, fax (978) 750-4470, or on the web at www.copyright.com. Requests to the Publisher for permission should be addressed to the Permissions Department, John Wiley & Sons, Inc., 111 River Street, Hoboken, NJ 07030, (201) 748-6011, fax (201) 748-6008, or online at http://www.wiley.com/go/permissions.

Limit of Liability/Disclaimer of Warranty: While the publisher and author have used their best efforts in preparing this book, they make no representations or warranties with respect to the accuracy or completeness of the contents of this book and specifically disclaim any implied warranties of merchantability or fitness for a particular purpose. No warranty may be created or extended by sales representatives or written sales materials. The advice and strategies contained herein may not be suitable for your situation. You should consult with a professional where appropriate. Neither the publisher nor author shall be liable for any loss of profit or any other commercial damages, including but not limited to special, incidental, consequential, or other damages.

For general information on our other products and services or for technical support, please contact our Customer Care Department within the United States at (800) 762-2974, outside the United States at (317) 572-3993 or fax (317) 572-4002.

Wiley also publishes its books in a variety of electronic formats. Some content that appears in print may not be available in electronic formats. For more information about Wiley products, visit our web site at www.wiley.com.

Library of Congress Cataloging-in-Publication Data:

Muir, Jerry R. Complex analysis : a modern first course in function theory / Jerry R.
Muir, Jr. pages cm Includes bibliographical references and index. ISBN 978-1-118-70522-3 (cloth)
1. Functions of complex variables. 2. Mathematical analysis. I. Title. QA331.M85 2014 515-dc23

2014035668

Printed in the United States of America

10 9 8 7 6 5 4 3 2 1

CONTENTS

	Pref	ace	ix
1	The	Complex Numbers	1
	1.1	Why?	1
	1.2	The Algebra of Complex Numbers	3
	1.3	The Geometry of the Complex Plane	7
	1.4	The Topology of the Complex Plane	9
	1.5	The Extended Complex Plane	16
	1.6	Complex Sequences	18
	1.7	Complex Series	24
2	Com	plex Functions and Mappings	29
	2.1	Continuous Functions	29
	2.2	Uniform Convergence	34
	2.3	Power Series	38
	2.4	Elementary Functions and Euler's Formula	43
	2.5	Continuous Functions as Mappings	50
	2.6	Linear Fractional Transformations	53
			vii

	2.7	Derivatives	64
	2.8	The Calculus of Real-Variable Functions	70
	2.9	Contour Integrals	75
3	Analytic Functions		
	3.1	The Principle of Analyticity	87
	3.2	Differentiable Functions are Analytic	89
	3.3	Consequences of Goursat's Theorem	100
	3.4	The Zeros of Analytic Functions	104
	3.5	The Open Mapping Theorem and Maximum Principle	108
	3.6	The Cauchy–Riemann Equations	113
	3.7	Conformal Mapping and Local Univalence	117
4	Cau	chy's Integral Theory	127
	4.1	The Index of a Closed Contour	127
	4.2	The Cauchy Integral Formula	133
	4.3	Cauchy's Theorem	139
5	The	Residue Theorem	145
	5.1	Laurent Series	145
	5.2	Classification of Singularities	152
	5.3	Residues	158
	5.4	Evaluation of Real Integrals	165
	5.5	The Laplace Transform	174
6	Harr	183	
	6.1	Harmonic Functions	183
	6.2	The Poisson Integral Formula	191
	6.3	Further Connections to Analytic Functions	201
	6.4	Fourier Series	210
	Epil	ogue	227
Α	Sets	and Functions	239
в	Торі	ics from Advanced Calculus	247
	Refe	erences	255
	Inde	×	257

...