

Michio Kuga

Galois' Dream:

Group Theory and Differential Equations

Susan Addington

Motohico Mulase

Translators



Springer Science+Business Media, LLC

Translator:
Susan Addington
Department of Mathematics
California State University
San Bernardino, CA 92407
USA

Translator:
Motohico Mulase
Department of Mathematics
University of California
Davis, CA 95616
USA

Library of Congress Cataloging-in-Publication Data

Kuga, Michio, 1928-1990.

[Garoa no yume. English]

Galois' dream: group theory and differential equations / Michio

Kuga ; translated by Susan Addington and Motohico Mulase.

p. cm.

Includes bibliographical references and index.

ISBN 978-1-4612-6710-2 ISBN 978-1-4612-0329-2 (eBook)

DOI 10.1007/978-1-4612-0329-2

1. Galois theory. 2. Differential equations. 3. Monodromy groups. I. Title.

QA174.2.K8413 1993

512'.3--dc20

92-41486

CIP

Printed on acid-free paper.

© Springer Science+Business Media New York 1993

Originally published by Birkhäuser Boston in 1993



Originally published in Japanese in 1968 by Nippon Hyoron Sha Co., Tokyo, Japan.

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, or otherwise, without prior permission of the copyright owner.

Permission to photocopy for internal or personal use of specific clients is granted by Springer Science+Business Media, LLC for libraries and other users registered with the Copyright Clearance Center (CCC), provided that the base fee of \$6.00 per copy, plus \$0.20 per page is paid directly to CCC, 21 Congress Street, Salem, MA 01970, U.S.A. Special requests should be addressed directly to Springer Science+Business Media, LLC

Typeset in TeX by Susan Addington.

Contents

Preface	vii
-------------------	-----

Pre-Mathematics

0th Week	No prerequisites	3
1st Week	Sets and Maps	5
2nd Week	Equivalence Classes	19
3rd Week	The Story of Free Groups	23

Heave Ho! (Pull it Tight)

4th Week	Fundamental Groups of Surfaces	33
5th Week	Fundamental Groups	38
6th Week	Examples of Fundamental Groups	45
7th Week	Examples of Fundamental Groups, continued	49

Men Who Don't Realize That Their Wives Have Been Interchanged

8th Week	Coverings	53
9th Week	Covering Surfaces and Fundamental Groups	59
10th Week	Covering Surfaces and Fundamental Groups, continued	61
11th Week	The Group of Covering Transformations	70

Everyone Has a Tail

12th Week	The Universal Covering Space	77
13th Week	The Correspondence Between Coverings of $(D; O)$ and Subgroups of $\pi_1(D; O)$	83

Seeing Galois Theory

14th Week	Continuous Functions on Covering Surfaces	89
15th Week	Function Theory on Covering Surfaces	93

Solvable or Not?

16th Week	Differential Equations	105
17th Week	Elementary Methods of Solving Differential Equations	109
18th Week	Regular Singularities	114
19th Week	Differential Equations of Fuchsian Type	129
	References	141
	Notation	143
	Index	147