Lecture Notes in Mathematics 2018

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Blow-up Theories for Semilinear Parabolic Equations

Springer

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ISBN 978-3-642-18459-8 e-ISBN 978-3-642-18460-4
DOI 10.1007/978-3-642-18460-4
Springer Heidelberg Dordrecht London New York

Lecture Notes in Mathematics ISSN print edition: 0075-8434
ISSN electronic edition: 1617-9692

Library of Congress Control Number: 2011924396

Mathematics Subject Classification (2011): 35K10, 35K15, 35K57, 35K58, 35K51, 35J61, 35J15, 35J65

Cover design: deblik, Berlin

Printed on acid-free paper

Springer is part of Springer Science+Business Media (www.springer.com)

To Yi Cheng 程怡

Preface

I am grateful to Professor Zhengce Zhang (张政策) and his students from Xi'an Jiaotong university for correcting many typographic errors in my 2005 version of the lecture notes from their graduate reading seminar in the past few years. I am also grateful to the reviewers who offered constructive comments and suggested improvements of the manuscript. I would like to thank the editors of the LNM series for their suggestions, which improved the presentation of the materials and made the lecture notes more friendly to students. I would also like to thank Timothy McCoy for reading through the entire manuscript.

Notre Dame, IN *Bei Hu*
Fall 2010

These are the lecture notes of a course given at Xi'an Jiaotong university in summer of 2005. They are intended for beginning graduate students who have finished a first-year graduate course in basic partial differential equations.

The prerequisites include an understanding of the basic theory of the second-order equations such as

1. Maximum principles, basic existence and uniqueness theorems.
2. A priori estimates such as the Schauder estimates, the L^p estimates, the De Giorgi–Nash–Moser estimates, the Krylov–Safanov estimates.
3. The fixed point theorems.

There is an enormous amount of work in the literature about the blow-up behavior of evolution equations. It is our intention to introduce the theory by emphasizing the methods while avoiding the massive technical computations if possible. To reach this goal, we use the simplest equation to illustrate the methods; these methods very often apply to more general equations. No attempt is made during the lectures to include the most general theories and results.

I would like to use this opportunity to thank my colleagues at Xi'an Jiaotong University for their hospitality. In particular, I am grateful to Professor Jianzhong Shen (申建中), who corrected quite a few errors in an earlier version of the lecture notes. I am also grateful to Professor Lihe Wang (王立河), who invited me to give the lectures.

Xi'an, China *Bei Hu*
Summer 2005

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