# Monotonicity and Boundedness in general Runge-Kutta methods

Proefschrift

ter verkrijging van
de graad van Doctor aan de Universiteit Leiden,
op gezag van de Rector Magnificus Dr. D.D. Breimer,
hoogleraar in de faculteit der Wiskunde en
Natuurwetenschappen en die der Geneeskunde,
volgens besluit van het College voor Promoties
te verdedigen op dinsdag 6 september 2005
klokke 15.15 uur

door

Luca Ferracina

geboren te Vicenza, Italië
in 1973

Samenstelling van de promotiecommissie:

| | |
|---|---|
| promotors: | Prof.dr. M.N. Spijker<br>Prof.dr. J.G. Verwer (UvA/CWI) |
| referent: | Dr. W. Hundsdorfer (CWI) |
| overige leden: | Prof.dr. G. van Dijk<br>Prof.dr.ir. L.A. Peletier<br>Prof.dr. S.M. Verduyn Lunel |

*Alla mia famiglia:*
*papà, mamma, Marco, Anna.*

# Monotonicity and Boundedness in general Runge-Kutta methods

Thomas Stieltjes Institute
for Mathematics

# Preface

This thesis consists of an introduction and four papers which appeared (or were submitted for publication) in scientific journals. The introduction has been written with the intention to be understandable also for the reader who is not specialized in the field. The papers, which are listed below, are essentially self-contained, and each of them may be read independently of the others.

FERRACINA L., SPIJKER M.N. (2004): Stepsize restrictions for the total-variation-diminishing property in general Runge-Kutta methods, *SIAM J. Numer. Anal.* **42**, 1073–1093.

FERRACINA L., SPIJKER M.N. (2005): An extension and analysis of the Shu-Osher representation of Runge-Kutta methods, *Math. Comp.* **249**, 201–219.

FERRACINA L., SPIJKER M.N. (2005): Computing optimal monotonicity-preserving Runge-Kutta methods, submitted for publication, report Mathematical Institute, Leiden University, MI 2005-07.

FERRACINA L., SPIJKER M.N. (2005): Stepsize restrictions for total-variation-boundedness in general Runge-Kutta procedures, *Appl. Numer. Math.* **53**, 265–279.

# Contents