This thesis is not only the result of the four years of my doctorate studies at the Korteweg-de Vries Institute for Mathematics but is also the product of all the people who have supported me as student, researcher, teacher, friend, brother and (grand)son. I do not want to miss this opportunity to publicly thank them for all I have received.

First and foremost I would like to thank my co-promotor, Jan Brandts, for the opportunity to have worked with him. Your dedication to your students is outstanding and I was privileged to have witness it first hand. Your help has been precious and your comments have always challenged me to improve. During these years we were able to go over the supervisor-student paradigm and share also our personal lives. I have learned a lot from you at both levels. Thank you for everything.

I want to thank also to my promoter Rob Stevenson for the remarks on the early versions of this thesis. They were always very precise and allowed me to greatly improve this text. I also greatly appreciated the independence you gave me while assisting you in the Numerical Algorithms course.

Jan Wiegerinck has always made me feel welcome at the department. Despite your busy schedule you always found time to answer my questions and requests or to listen to my remarks. Not only did I deeply enjoyed assisting you in Analyse 3 but I have learned a lot and had great fun doing so.

I am in debt also to Gerard Sleijpen. I would not have started my PhD studies if you haven’t made me interested in Numerical Linear Algebra. I have always valued and respected your knowledge, your advices and your sharp comments and the remarks you made on the manuscript have been very helpful in improving this thesis.

Enno was the first other PhD candidate I met when I arrived at the KdV. We shared an office for a while at the beginning and later when we moved to the Science Park. You were always a big help especially in the first times explaining me who was who at the department and helping me with translations of all kind of forms I needed to fill. I regret not having had the chance to watch one of your concerts but maybe there will still be time for that. With Jevgenijs I have had quite some sporty time. Mud walking in Friesland, climbing and slacklining in Amsterdam and even some invitation for "badminton" which I was unable to
attend. Your good mood and friendliness were contagious and your adventures were always fun to listen to. Thank you both for everything and I wish you the best of lucks with your plans for the future.

I really enjoyed moving to the new building as there was, finally, a group of PhD candidates with which to share some time outside work. Loek, Piotr, Benjamin, Nabi, Paul, Naser, Abdel, Michel I had really a great time with the drinks and the dinners we had and the football games we watched together.

I am grateful to Andries for all the nice lunches. I have learned a lot from our discussions and despite our divergences in teaching methods your dedication to your students is something I set as an example for myself. To Evelien and Hanneke I want to thank the patience with all my questions and help requests for all kind of issues. You were always very kind and always ready to help make everything so much simpler. To my students throughout these years. I can now tell you that you have, unknowingly, been subjects of teaching experiments I have conducted. You gave me the time to learn how to better communicate, and your questions, feedback and critics have made me a better teacher, a better mathematician and a better researcher. Above all, it has been a great pleasure assisting you with your learning processes.

During the last four years many people have come and gone from the KdV institute. To some of them I want to leave a special thanks and wish them a lot of success in their new endeavors. To Kamyar for all the truly fun Fridays we have spent working on our RKFEM. It is unfortunate that we were unable to finish the 3D version but I have really enjoyed the work. To Phyllis, for our talks and discussions. They were always refreshing and have allowed my mind to rest as it wondered away from mathematics. To Niels for your precise observations on the experiences of expats in the Netherlands. Many times I end up in situations where I remember our conversations and just start laughing! I really enjoyed sharing the office with you and your advices on how to handle my time as a PhD candidate have been very useful. I know I still have an offer for a guided tour to Berlin and I hope I will take it soon.

It was super to co-organize the PhDays 2008 and 2009 with such enthusiastic group of people. Albert-Jan, Joris, Jok Tang, Katrijn, Liesbeth and Peter Lucas, not only am I really proud of what we did but thanks to all of you I had such a great time in our meetings.

I owe a great deal also to many people outside the mathematics community. First, to Roxanna, to whom and above everything I am grateful for keeping me
sane during the last years. Whatever the context you have always prevented me from loosing track of what is important. I will do my best to do the same for you during next four years ;) I have always admired the causes you support and the passion with which you do it and I will never forget how you, your family and your friends have welcomed me so wonderfully in Peru in a trip from which I have only good memories. To Ivelina for the company over the last years to visit museums, going to theaters, watching movies, going to the beach and much more. I always had a wonderful time and it was great to share all those things with someone with such a contagious enthusiasm. To Raquel and Arnt for all the delicious and funny dinners and parties. From sportsman to prince, I do not remember ever having to think so much on how to dress for any other place. Above all I always had a lot of fun when we met and it was great to communicate in Portuguese for a change. To Elif for the concerts, the bike tours, the dinners and parties and especially for all the interesting people I have met through you. I wish you a lot of success for your new life.

Obrigado tambem a todos os meus amigos em Portugal em especial Anita, Nuno, Inês, André, Juliana, Inês, António e Joana por me receberem maravilhosamente sempre que estou por Portugal, pelos jantares, pelas tardes em cafés, por me visitarem e por me continuarem a deixar fazer parte das vossas vidas.

À minha irmã, Patricia, també tenho imenso por que agradecer. O facto de eu não estar em Portugal significa que tens o dobro do fardo em organizar coisas, comprar presentes e tomar conta de toda a gente. Tens tido uma paciência fantástica para tudo isso e tens-no feito de uma maneira soberba. Estou mesmo profundamente agradecido.

Finalmente, aos meus pais e avós. Eu sei que vos tem custado especialmente o facto de eu não viver tão perto como gostaríamos. Infelizmente ainda não vos posso dizer que acabou. Eu sei que não entendem as minhas opções completamente e que, sem duvidar que estejam contentes comigo, gostariam que a minha vida fosse diferente. Eu sinto-me um privilegiado por poder viver da maneira que quero. Viver a minha vida o melhor possível para mim e para os outros é honrar a educação e as oportunidades que me deram. Obrigado por tudo isso e por todo o apoio que me continuam a dar.

Thank you all,

Ricardo

10 June 2011