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## Foreword

In the second half of September 2008, I<sup>1</sup> organized the first edition of the *Symposium on Recent Trends in the Numerical Solution of Differential Equations*, within the 6-th International Conference of Numerical Analysis and Applied Mathematics, ICNAAM 2008, held in Kos, Greece, on September 16–20, 2008.<sup>2</sup> There were eleven speakers scheduled for the symposium: among them Felice Iavernaro, delivering a talk entitled “Conservative Boundary Value Methods for the solution of polynomial Hamiltonian systems”. This information can still be retrieved at the URL of the symposium:

<http://web.math.unifi.it/users/brugnano/ICNAAM2008/>

Even though the talk was only 25 mins long (this was the time-slot for each talk in the symposium), I was impressed by the elegant and simple idea behind the methods presented by Felice. I approached him, just after the talk, and remember saying to him: – *Felice, I have not understood all the details about the methods, but the idea you have outlined is an “idea”* – meaning that the important ideas, in Mathematics, are relatively few.

This was the first time I heard about the derivation of conservative numerical methods, for Hamiltonian problems, obtained by using the so called *discrete line integral approach*, which was the name that Felice and his co-author (Brigida Pace, a former PhD student of Felice) gave to this methodological framework.<sup>3</sup> Felice answered to me: *I am glad that you liked my presentation*, – then continuing – *maybe we can collaborate on this topic*.

This was the beginning of our research collaboration, whose main achievements are covered in this book. The subsequent year, in the *Second Symposium on Recent Trends in the Numerical Solution of Differential Equations*, within the 7-th International Conference of Numerical Analysis and Applied Mathematics, ICNAAM 2009, held in Rethymno, Greece, on September 18–22, 2009, the basic framework of the methods was presented in two talks of ours, still available at the URL of the symposium:

<http://web.math.unifi.it/users/brugnano/ICNAAM2009/>

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<sup>1</sup>Luigi Brugnano.

<sup>2</sup>This is a conference series organized by Theodore Simos.

<sup>3</sup>In the previous edition of the same conference series (the 5-th International Conference of Numerical Analysis and Applied Mathematics, ICNAAM 2007, held in Corfu, Greece, on September 16–20, 2007), Felice Iavernaro presented the first instance of such methods, named *s-stage trapezoidal methods*, which were generalized in his 2008 talk.

Actually, this research initially involved also our former advisor, professor Donato Trigiante, who passed away on September 18, 2011. This book is dedicated to his memory. We shall try, at our best, to follow his clear line of reasoning, based on the simplest possible mathematical arguments, in accordance with his preferred *motto* (slightly adapted from the Okham's Razor): "*Frustra fit per plura quod potest per pauciora*".<sup>4</sup>

We are sincerely grateful to Theodore Simos, the chairman of the ICNAAM Conference series, for having provided the venue for this project to start and consolidate, as well as for his support (also economical) for attending some of the ICNAAM editions.

We would like to express our sincere gratitude to all the people that have supported us during the preparation of the manuscript. Among them, we mention Lidia Aceto, Pierluigi Amodio, Gianluca Frasca Caccia, Cecilia Magherini, Francesca Mazzia, Juan Montijano, and Luis Rández, for reading parts of the manuscript and for providing us with valuable remarks and comments.

Last, but not least, we wish to thank our families, for having allowed us to devote a significant part of our free time to this project.

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<sup>4</sup>I.e., "It is pointless to use more involved arguments, when simpler ones suffice."