

Festschrift

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Maurice H. ter Beek
Stefania Gnesi
Anne E. Haxthausen
Laura Semini (Eds.)

Journeys Between Formal Methods and the Railway Industry

**Essays Dedicated to Alessandro Fantechi
on the Occasion of His 70th Birthday**



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Maurice H. ter Beek · Stefania Gnesi ·
Anne E. Haxthausen · Laura Semini
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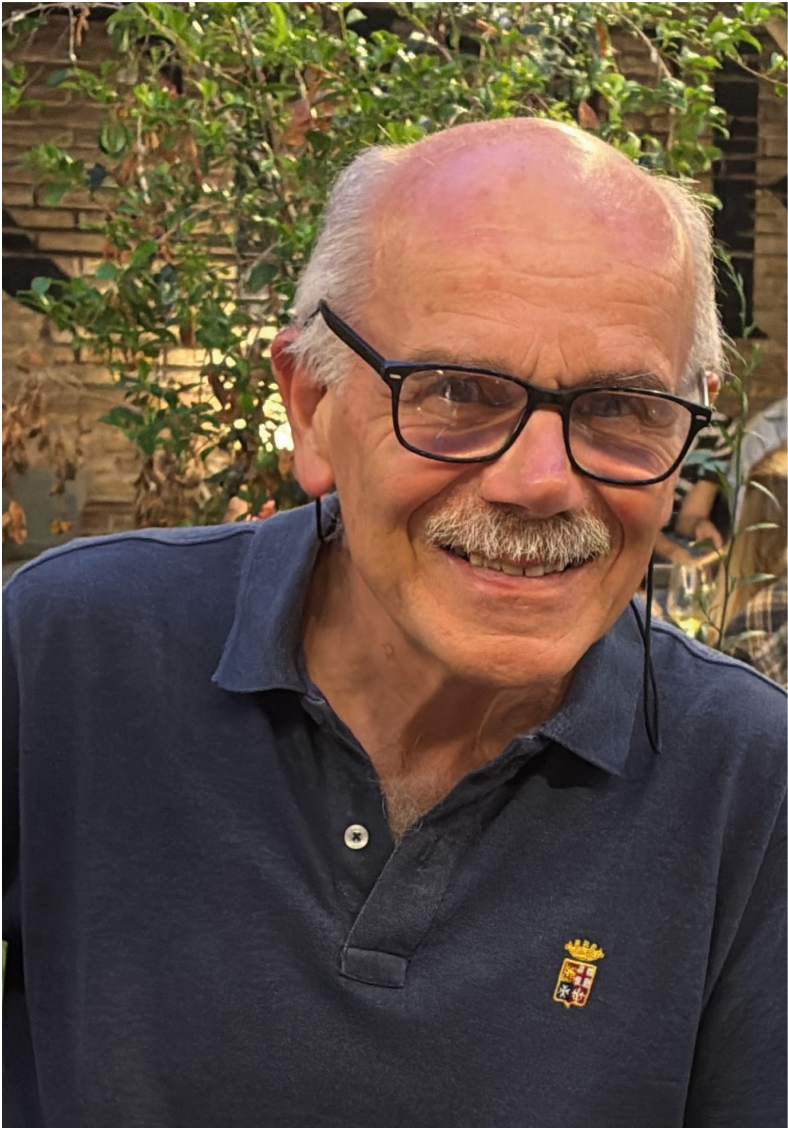
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Alessandro Fantechi – Summer 2025

Preface

This Festschrift contains 18 contributions by collaborators, colleagues and friends of Alessandro Fantechi to celebrate his 70th birthday.

Following a foreword that serves as a homage to Alessandro (Sandro for friends) and personal recollections from Alessandro's brother, these 18 contributions are grouped into three sections that reflect Alessandro's research, namely *journeys between formal methods and the railway industry*.

Each research contribution was carefully reviewed by two readers. We would like to thank these colleagues, all contributors to this Festschrift, listed below, for their assistance.

The Festschrift was presented to Alessandro on November 28, 2025, during an afternoon colloquium held in Pisa, Italy, succeeding the 6th International Conference on Reliability, Safety, and Security of Railway Systems (RSSRail 2025). We would like to thank the Scuola Normale Superiore (SNS), and in particular Fosca Giannotti, for hosting the Festschrift colloquium celebrating Alessandro, who's a former student of the SNS.

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Finally, we would like to thank Springer for agreeing to publish this Festschrift and we acknowledge the support from Easy-Chair in assisting us in managing the complete process from submissions to this volume.

November 2025

Maurice H. ter Beek
Stefania Gnesi
Anne E. Haxthausen
Laura Semini





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Foreword

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Sandro's research journey has reliably pursued a clear and coherent goal: rigorous modeling and analysis of challenging safety-critical systems, particularly in the railway domain, through the systematic development and application of formal methods and tools throughout the entire system's life cycle.

A significant portion of his work has been devoted to the application of formal methods for the formal verification of system properties by means of model checking. In this regard, his contributions to the railway sector have played a particularly prominent role, advancing the field both in theory and in practice.

Although verification has been a central focus of his research, Sandro has also shown a strong commitment to validation activities. He has proposed and evaluated approaches for both testing and runtime monitoring, always with a keen eye on their practical applicability in industrial settings. His work, especially in the context of safety-critical systems, stands out for its balance between scientific rigor and real-world relevance.

This Festschrift volume is a tribute to Sandro's scientific journey between formal methods and railway industry—marked by intellectual depth, methodological precision, and a constant drive to bridge academic research with practical challenges. It also reflects the respect and admiration of the many colleagues who have had the pleasure of working with him, learning from his insights, and sharing his passion for safety-critical (railway) systems.

Sandro has a unique talent for identifying what really matters in research, combined with a clear vision of how to achieve it. His ideas are truly innovative, frequently ahead of their time, and have often led to high-impact results.

But Sandro is more than a great researcher. He is a remarkable person: caring, generous, insightful and always a joy to be around. He is a wonderful colleague and friend. The four of us have had the privilege of collaborating with him for many years, and it has been a true pleasure to share not only a professional journey, but also a personal friendship. For this, we are deeply grateful. Working with him has been not only productive, but also personally rewarding.

Sandro, thank you for so many years of outstanding collaboration and friendship. Our warmest congratulations on your birthday and our very best wishes for a happy, healthy, and fulfilling journey ahead—may it always run on the right track! 🚆

Personal Recollections

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For this Festschrift for Alessandro, I would like to add some personal recollections. The title of this volume is “Journeys Between Formal Methods and the Railway Industry”. I am not at all an expert on formal methods (my work as an experimental particle physicist many times is everything but formal . . .), but I can offer a comment about Alessandro as a railway enthusiast, like myself: with a rough estimation, he and I have each travelled by train for a total distance of at least one one-way trip Earth–Moon.

I want then to outline the roots of both Alessandro’s works in the Railway Industry and in Formal Methods.

In the sixties, it was very common for kids to have an electric train setup of some dimension. Following a gift from our grandfather, we started to develop our game setup with the support of our father who, with his ingenuity, prepared a removable plane with rails and a box with a transformer and a rectifier to power our locomotives. The plane usually stayed hidden in the closet and was deployed on our beds on rainy Sundays for some hours of playing.

Later, in early adolescence, with Alessandro’s “leadership”, we started to identify and classify with a “phenomenological approach” the coding of the various wagons (and in particular freight ones), visiting the freight yard in Florence or looking out of the windows during our frequent train journeys.

A little bit later, we started to play with electronics, again with the early trigger and support by our father. We built radios, amplifiers and other objects. In the early seventies we discovered digital electronics and built and debugged a digital frequency meter. Alessandro was more interested than me in digital logic and I can remember a lot of paper sheets with logic schematics, Karnaugh maps, truth tables and so on. The choice of the Computer Science faculty followed naturally.

I hope that these personal recollections will please Alessandro (he always says that I remember the past better than him) and I join the community saying: *Happy birthday Sandro!*

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