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Dedicated to Daan and Savitri
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Preface to the Second Edition

When the first edition of this book was first published in 2008, my goal was to create a book presenting up-to-date techniques to analyze data collected from onboard data logging systems in race cars. Since the first edition, I have received a great deal of feedback from people all over the world indicating that I was successful in obtaining this goal. I am extremely happy that this book has been able to fill a void in this ever-developing area.

However, since 2008 my personal understanding of this subject has evolved. First of all, the technology has developed, making it possible to obtain more advanced and accurate data regarding the performance of race cars at less cost. There are a number of observations that have led me to write this second edition.

Some race series have actively restricted data logging to decrease the team’s running budgets. In these cases, it is extremely important that a maximum of information be extracted and interpreted from the hardware that is at hand. Although I do not agree with the philosophy of limiting data acquisition by sporting regulations, it does level the field, as everybody will have access to the same information. This means that a team that uses the data more efficiently will have an edge over the competition.

The opposite is also true. The ever-decreasing cost of electronics makes advanced sensors and logging capabilities more accessible for everybody. With this comes the risk of information overload. There will be a point where a team will no longer be able to process all the available data. Therefore, techniques need to be provided that will help in drawing the right conclusions quickly from very large data sets.

I wanted to include newly gained knowledge since the first publication. Experience is a continuous process, and I felt that the time had come to upgrade the book. There were some items in the first edition that needed to be addressed, explained better, or with more examples. The book contains three new chapters. The first (chapter 8) covers the techniques that are available to analyze tire performance. The second (chapter 17) gives an introduction to metric-driven analysis, a technique that is used throughout the book. Finally, a chapter was added to explain what kind of information the data contains about the track being driven on (chapter 18).
Preface to the First Edition

A proven way for athletes to be successful in any sporting discipline is for them to record their performance, analyze what has happened, and draw conclusions from the factors that influence that performance. Marathon runners log their running speed and distance along with their heart rate to optimize their training schedules. Football players record their games on video to evaluate techniques, performance, and tactics. Chess players write down every move in a game to replay and analyze it afterward. They measure something, learn from it, and try to use it to their advantage the next time.

In motor racing, sophisticated recording devices are used in conjunction with numerous sensors to record what the car and its driver are doing. Engineers often are employed full-time to maintain the system, analyze the recorded data, and draw the correct conclusions from it.

Motor racing is known for high-end technology, and this technology changes every day. Ten years ago, race car data acquisition was somewhat limited to well-funded teams in high-profile championships. Nowadays, the cost of electronics has decreased dramatically. Powerful computers are available for very little expense. Data acquisition systems are now sold for the price of a single racing tire. This means data acquisition has become accessible to everyone.

Whatever the price of the data acquisition system, it is a waste of money if the recorded data is not interpreted correctly. This book contains enough information to prevent the investment in a data acquisition system from being a waste of money.

Whether measuring the performance of a Formula One race car or that of a road-legal street car on the local drag strip, the dynamics of the vehicles and their drivers remain the same. Identical analysis techniques apply. This book contains a collection of techniques for analyzing data recorded by any vehicle’s data acquisition system. It details how to measure the performance of the vehicle and driver, what can be learned from it, and how this information can be used to your advantage the next time the vehicle hits the track.
When I began working in motor racing in 1998, I soon learned that this business is a team effort. The sum of the qualities of each member determines the team’s success. Eight years later, when I wrote this book, I learned this also is a team effort, very similar to running a successful racing team. That is why I would like to begin by appropriately crediting “my” team.

First, I would like to thank everyone at SAE International for guiding this project in the right direction. Special thanks go out to Martha Swiss, intellectual property manager, Heather Slater, product developer, Terri Kelly, administrative assistant, and Terry Wilson for artwork.

A big contributor to this book was Josep Fontdecaba I. Buj, engineering director at Creuat S.L.; not only for writing chapter 12 but especially for the many discussions we had about suspension setup and data analysis. His input added immeasurable value to this book.

David Brown and Andrew Durant at Race Technology gave me detailed insight about GPS-based data acquisition techniques. I would like to thank them for providing me with the hardware that was used to create much of the data traces used throughout this book. Their company is proof that data acquisition can be affordable for all motor racing disciplines.

I am proud to have Cosworth Electronics support the creation of this book. The information and analysis files supplied by this company were invaluable. Thanks go out to Thomas Buckler, Robert Kirk and Michael de Cock.

The following people deserve credit for taking the time to evaluate the manuscript and for providing me with invaluable feedback: Peter Wright (consultant to the FIA), Dr. Wolfgang Ullrich (head of Audi Sport), John Glimmerveen (author of the book Hands-on Racecar Engineer), Doug and Bill Milliken (authors of the book Racecar Vehicle Dynamics), and William C. Mitchell (head of Mitchell Software).

This book addresses what I know about race car data acquisition, and what I know is influenced greatly by the people I had a chance to work with. Therefore, my great respect goes out to all the engineers, mechanics, and team owners that were there to teach me. I hope I can repay these debts when they read this book.

Every graph in this book was created by a race car driver. Many of these graphs resulted in successful track performance, pole positions, race victories, and championships. I thank all of these drivers for providing me with data to analyze.
Acknowledgments

Henrik Roos of the Simbin Development Team is the person that triggered my interest in technical writing. He gave me the idea to write a book on this little-documented subject in the first place.

Special thanks for this second edition go out to Pierre-Alain Aucouturier and Philippe Leuwers at Texys Sensors for their support and detailed supply of information on the latest sensor technologies. Also Giuseppe Callea of BHAI TECH srl. deserves special mention for his contribution in chapter 3 on the evaluation of sensor reading accuracies and the interesting discussions on simulation techniques.

I would like to thank Tony Gardner and David Tucker of iRacing.com for their help with the chapter on simulation. The first edition of this book proved quite popular in the online racing community. It surprised me to find out how close something—that is often wrongfully considered as a computer game—resembles real racing. I am sure that this interest group will find a lot of useful information in this book.

Jörge Segers