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Analysis Techniques for
Racecar Data Acquisition
A Chat with Jorge Segers

2020 Webinar #62

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October 29th, 2020

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Jorge Segers

Data Engineer / Author



Competition Consultancy
JS Engineering BVBA

- Owner of JS Engineering BVBA
- Involved in Motorsport Since 1998
- Active in GT1, GT3, LMP1, LMP2, Brazilian Stock Car, Touring Cars, etc.
- Since 2013 mainly in DTM Championship with Audi as Engineer for Team ABT Sportsline
- 'Analysis Techniques for Racecar Data Acquisition'
 - 1st Edition in 2008
 - 2nd Edition in 2014

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Analysis Techniques for Racecar Data Acquisition

Second Edition



Jorge Segers

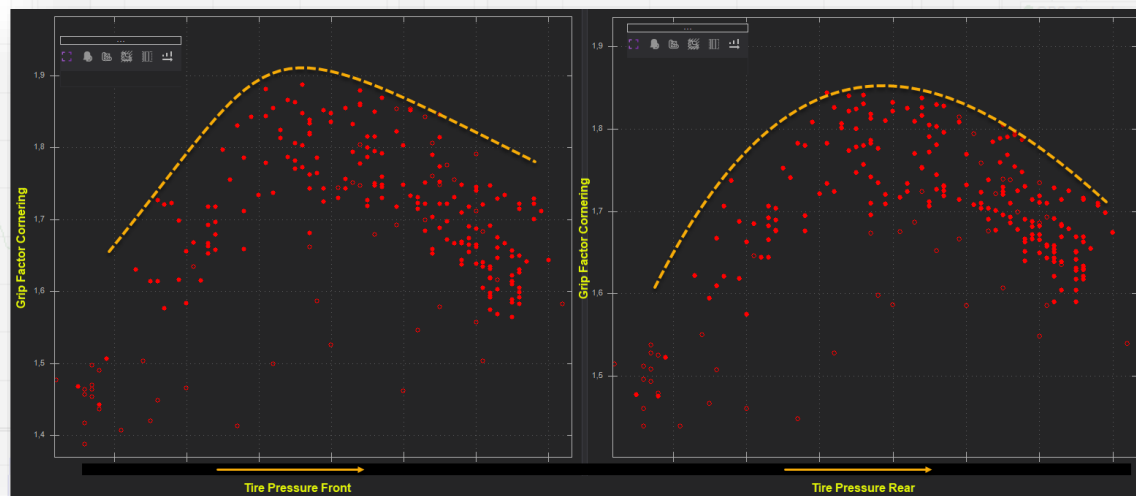


Metrics Based Data Analysis

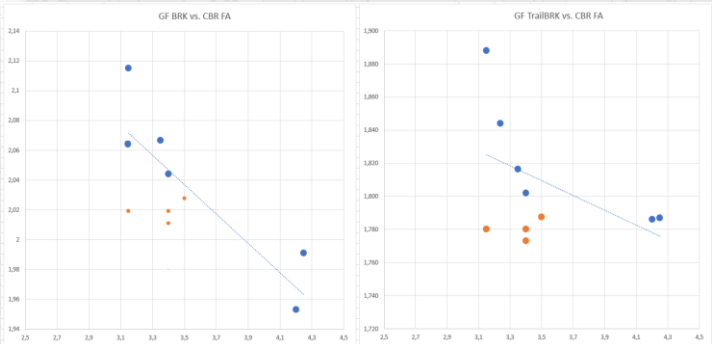
- 'Zooming out': gives us the possibility to summarize very big data sets in a limited amount of statistics, which makes the data easier to interpret
- Metrics are generally statistics that are calculated over a lap, but we can apply the same calculation to specific parts of the track (e.g. Corners, straights,...)
- These metrics can be analyzed for a specific lap, a run, a session, an event, a season,...
- Easier to spot trends over time
- If we know the values of specific metrics at which the car/driver/tire is performing well, we have a reference or target to work towards
- We can investigate correlations between metrics (for example, which brake balance results in the highest deceleration level for a specific corner)
- So, with metrics we can figure out which tire pressures, brake temperatures, ride heights, roll stiffness distribution, driving lines, etc... to run in order to extract the best performance from the car/driver/tire

Metrics Based Data Analysis – Grip Factors

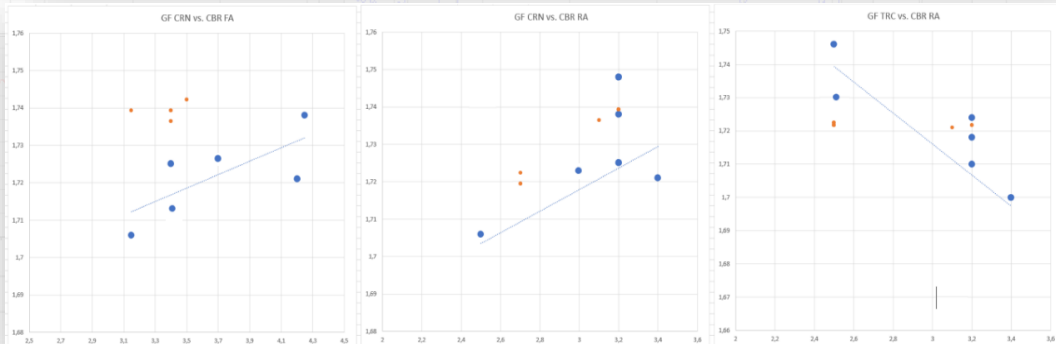
Grip Factors for Braking, Trail Braking, Cornering, Traction can be Calculated by Gating the Combined Acceleration Channel



Grip Factor Braking vs. Front Camber Grip Factor Trailbraking vs. Front Camber



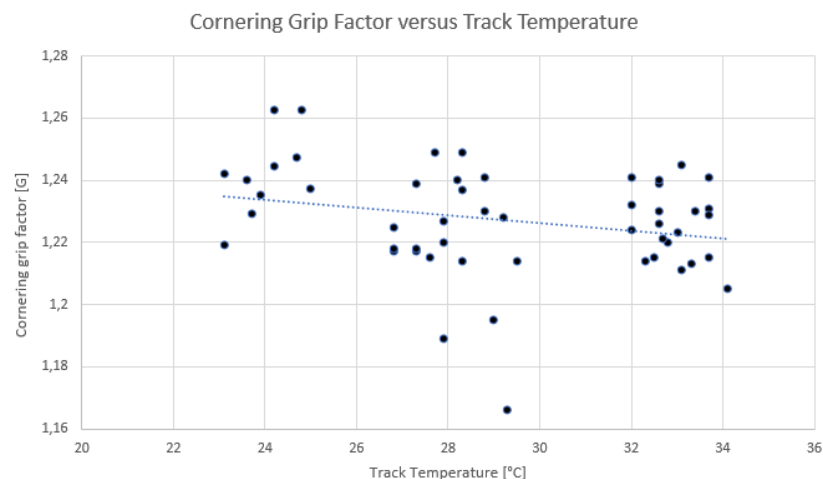
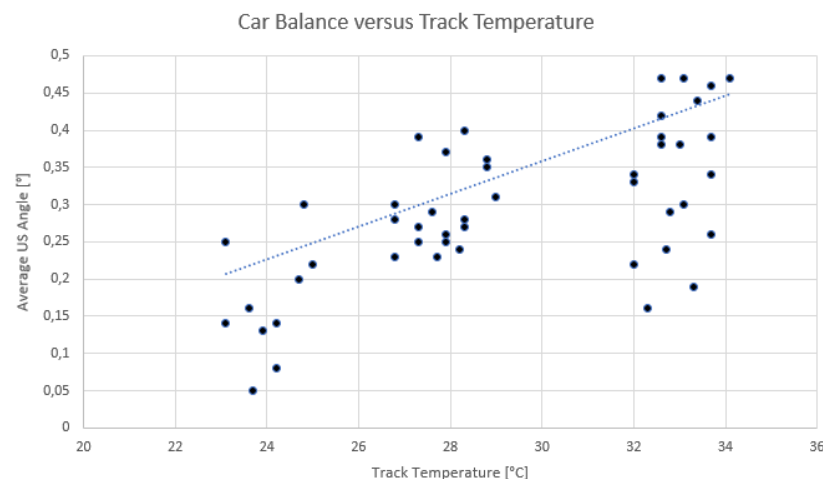
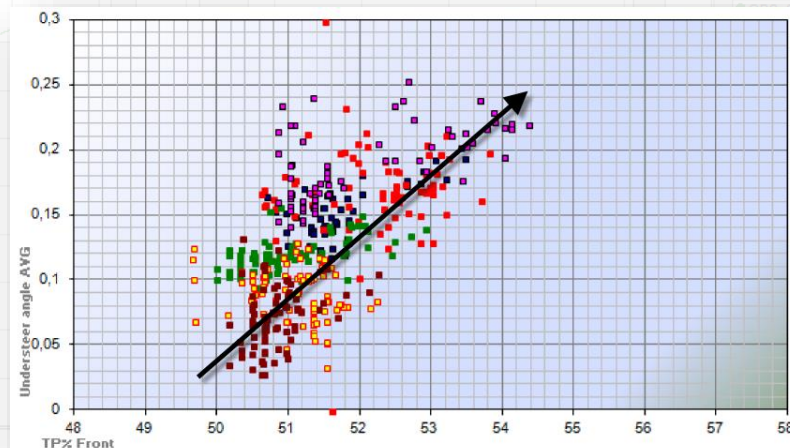
Grip Factor Cornering vs. Front Camber Grip Factor Cornering vs. Rear Camber Grip Factor Traction vs. Rear Camber



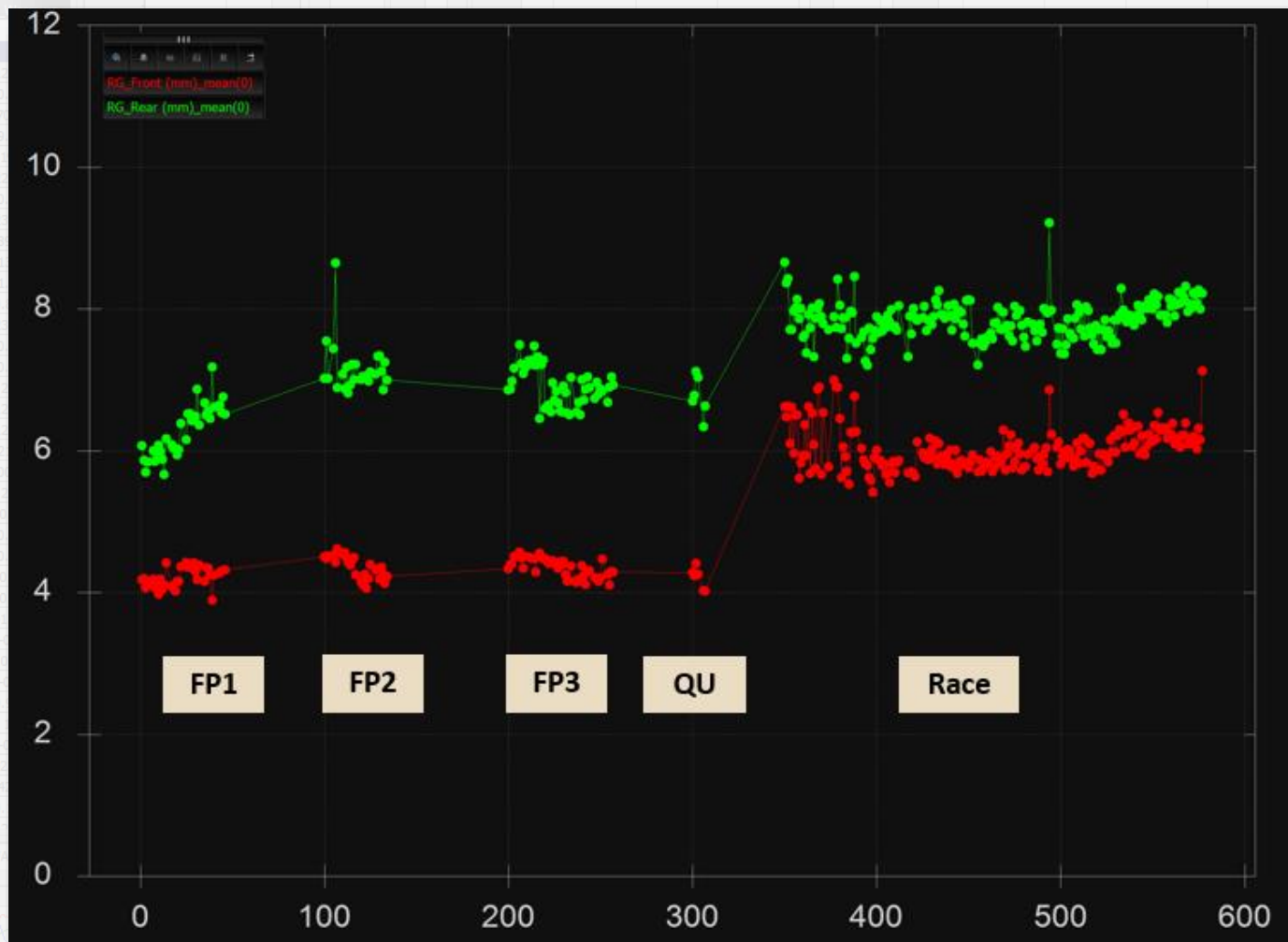
Metrics Based Data Analysis – Car Balance

$$\delta_u = \delta - \frac{WB \cdot G_{Lat}}{V^2}$$

Understeer Angle is a Measure for the Excess Steering Angle Required to go Through a Corner, Compared to a Neutral Car

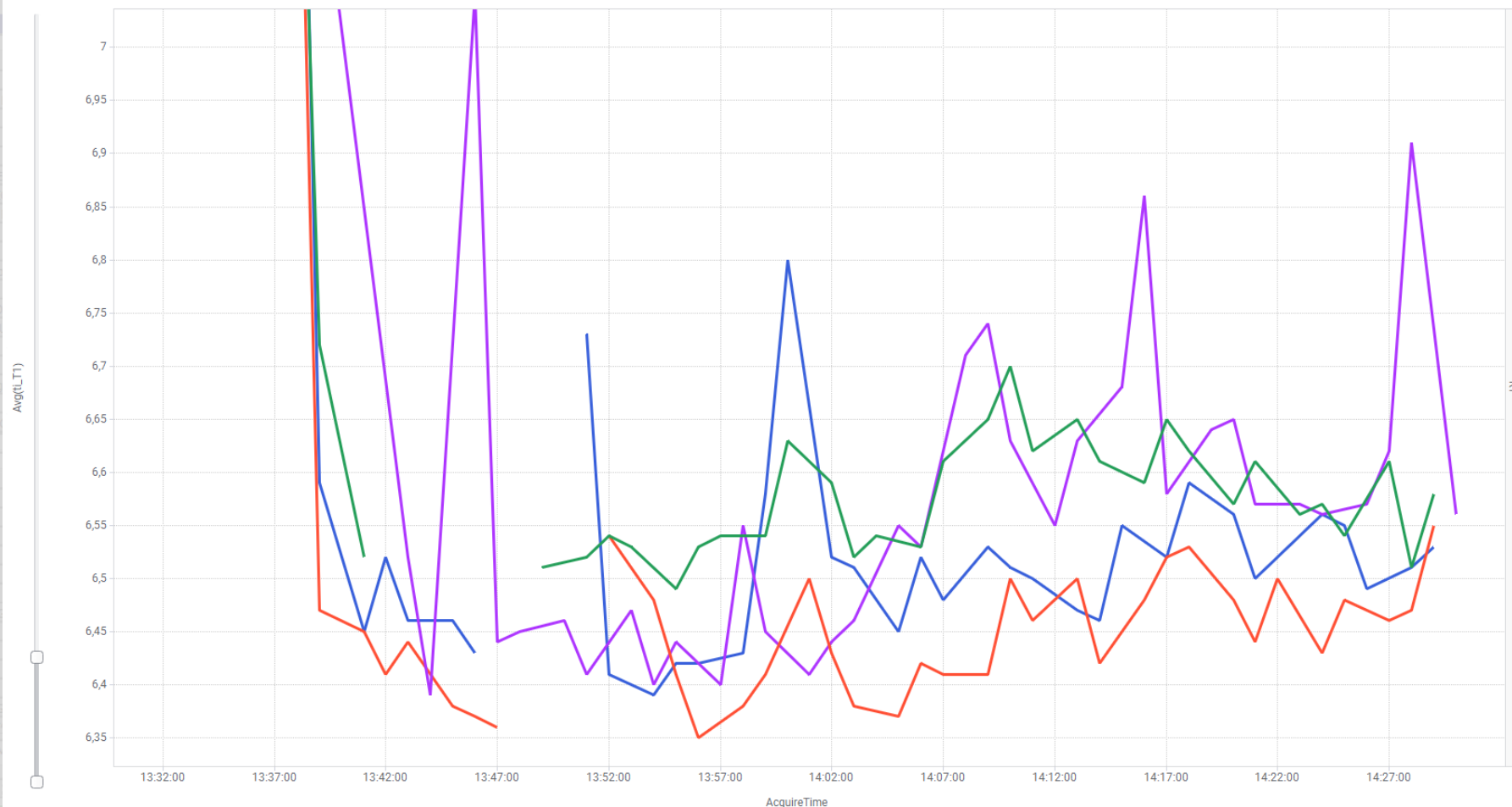


Metrics Based Data Analysis – Roll Stiffness



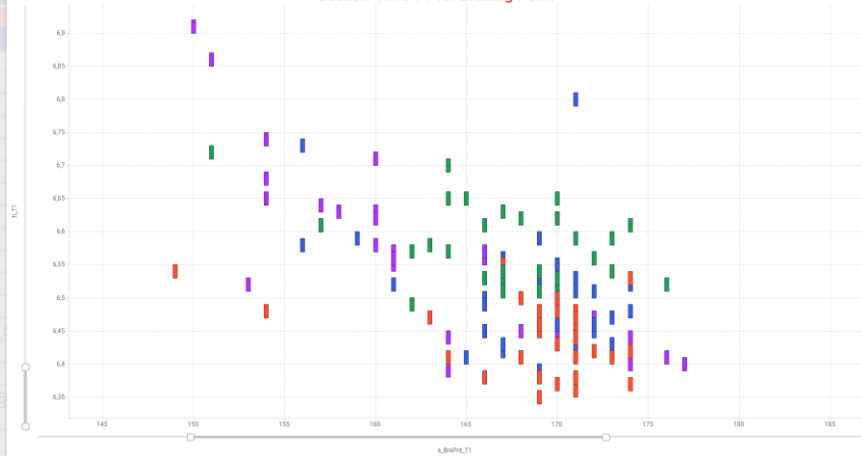
Metrics Based Data Analysis – Corner by Corner

Section Time T1



Metrics Based Data Analysis – Corner by Corner

Section Time T1 vs. Braking Point



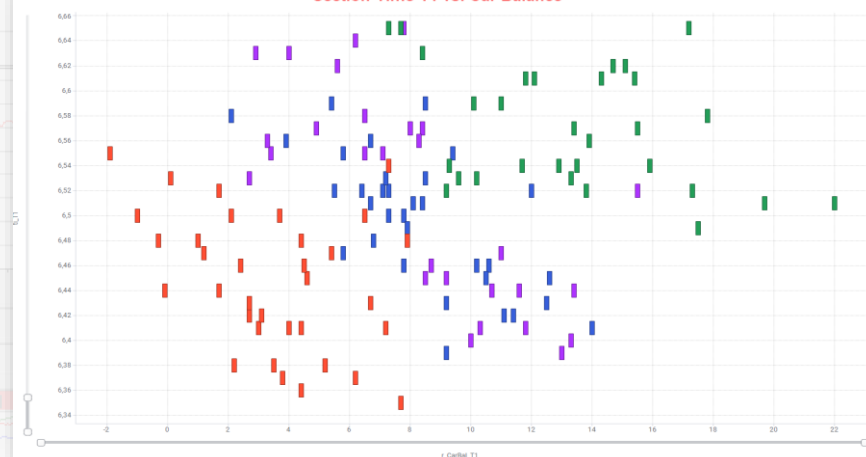
Section Time T1 vs. Minimum Corner Speed



Section Time T1 vs. Minimum Corner Radius



Section Time T1 vs. Car Balance





A Practical Guide to Race Car Data Analysis

Analysis Techniques for Racecar Data Acquisition Second Edition

Jörg Segers

Whether measuring the performance of a Formula One racecar or that of a road-legal street car on the local drag strip, the dynamics of 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 advantage the next time the vehicle hits the track.

Since the best-selling first edition was published in 2008, data recording technology has developed making it possible to obtain more advanced and accurate data regarding the performance of race cars at less cost.

In addition to updates throughout, this new edition contains three new chapters. Chapter eight covers the techniques that are available to analyze tire performance. Chapter 17 gives an introduction to metric-driven analysis, a technique that is used throughout the book. Chapter 18 was added to explain what kind of information the data contains about the track being driven on.



About the Author

Jörg Segers has been involved with racing disciplines such as GT and sportscar racing, single seaters, and touring cars since 1998. He apprenticed at GLPK Carsport and became team manager three years later.

After finishing studies in automotive engineering, he worked at BPR Competition Engineering as track engineer and later as development manager at Eurotech Racing. He has worked for other teams such as Henrik Roos Motorsports (FIA GT), Racing for Holland (Le Mans 24 Hours), DKR Engineering, Carsport Modena, and W-Racing Team.

In 2010 he founded JS Engineering BVBA, which provides engineering services to the motor racing industry and supplies data acquisition hardware to a multitude of organizations. In 2013 he began working for the German team Phoenix Racing where he is an engineer in the DTM championship with Audi.

Analysis Techniques for Racecar Data Acquisition Second Edition

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Analysis Techniques for Racecar Data Acquisition Second Edition



Jörg Segers

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A Chat With Jorge Segers

Analysis Techniques for
Racecar Data Acquisition



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Racecar data acquisition used to be limited to well-funded teams in high-profile championships. Today, the cost of electronics has decreased dramatically, making them available to everyone. But the cost of any data acquisition system is a waste of money if the recorded data is not interpreted correctly.

This book, updated from the best-selling 2008 edition, contains 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 advantage next time the vehicle hits the track. Such information is invaluable to racing engineers and managers, race teams, and racing data analysts in all motorsports.

Whether measuring the performance of a Formula One racecar or that of a road-legal street car on the local drag strip, the dynamics of vehicles and their drivers remain the same. Identical analysis techniques apply.

Some race series have restricted data logging to decrease the team's running budgets. In these cases it is extremely important that a maximum of information is extracted and interpreted from the hardware at hand. A team that uses data more efficiently will have an edge over the competition.

However, the ever-decreasing cost of electronics makes advanced sensors and logging capabilities more accessible for everybody. With this comes the risk of information overload. Techniques are needed to help draw the right conclusions quickly from very large data sets.

In addition to updates throughout, this new edition contains three new chapters: one on techniques for analyzing tire performance, one that provides an introduction to metric-driven analysis, a technique that is used throughout the book, and another that explains what kind of information the data contains about the track.

Author: Jorge Segers

Publisher: SAE International

Specs: Published by SAE International with a Product Code of R-408, ISBN of 978-0-7680-6459-9, and 534 pages in a hardbound binding.

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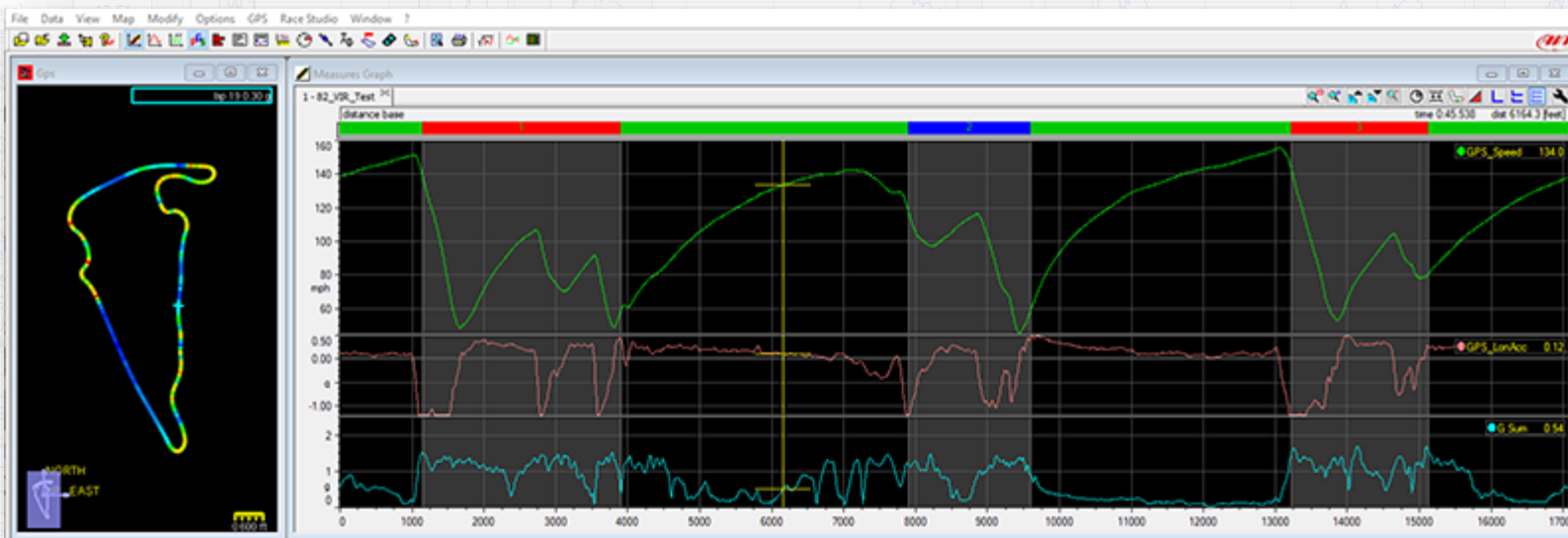
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