Traffic Flow Dynamics: Data, Models and Simulation
Martin Treiber and Arne Kesting
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This edition is the English translation of the original 2011 German textbook *Verkehrsdynamik und simulation* by Martin Treiber and Christian Thiemann. The contents of the book are exactly as its title suggests, written by authors currently working at the forefront of traffic flow dynamics research and development.

Arne Kesting is a physicist member of the Live Traffic Team at TomTom Development in Berlin. His thesis, "Microscopic Modeling of Human and Automated Driving: Towards Traffic-Adaptive Cruise Control," was awarded the Friedrich-List-Preis prize for best Ph.D. dissertation at the Faculty of Transportation and Traffic Sciences of the TU Dresden in 2008 and the Best Dissertation Award of the IEEE ITS Society in 2009. His work at TomTom advances the company's state-of-the-art, real-time traffic information and navigation software services and maintains it as a key partner for the development of advanced driver assistance systems (ADAS) and autonomous driving.

Martin Treiber is a senior research scientist and permanent faculty member at Institut fur Wirtschaft und Verkehr (Institute of Transport and Economics in Dresden). He has 100 publications and 200 citations in the field of transportation and traffic sciences. His research includes work on projects SANDY, VASIS, INVENT, AKTIV, KOLINE, COOL, MOVSIM and others related to traffic flow, intelligent traffic, adaptive cruise control, autonomous driving, trajectories and eco-routing for partners such as Volkswagen, TomTom, Teledyne Inc. and the German authorities for inland waterways. MOVSIM is a JAVA-based, open-source program used in many of the book's examples and made available to the reader for download at the companion website: www.traffic-flow-dynamics.com and companion open source simulator website: www.movsim.org.

As is to be expected in a German-to-English textbook translation, instead of being rephrased in English, some sentences are direct, compound-word translations resulting in several long, tortured chains of adjective–noun pairings that need to be mentally parsed to decipher. Even so, one cannot argue with the preciseness.

End-of-the-chapter problems are real thought producers, with 70 pages of fully developed solutions given in the appendix.

Although a majority of the graphs and illustrations are professionally done and informative, there remain a few low-quality cartoon sketches that seem out of place and add little or nothing to content and understanding.

As outlined in the book's subtitle, the text is divided into three sections: Part I — Traffic Data, Part II — Traffic Flow Modeling, and Part III — Applications of Traffic Flow Theory.

The Traffic Data section limits itself to incomplete data sets produced either from a relatively small set of instrumented vehicles within the traffic flow (floating car data) or from stationary sensors sparsely distributed within the traffic ways (cross-sectional data). It demonstrates how incomplete data can lead to conflicting interpretations and shows which reconstructions are most likely.

The Traffic Flow Modeling section introduces the various types and specific derivations of computer models presently used to model traffic flow. Model types are either 1) macroscopic, solving for fluid-like relationships between traffic density, velocity and pressure with equations based on hydrodynamics; 2) microscopic, prescribing equations governing position, velocity and acceleration of each individual vehicle relative to immediately adjacent vehicles, or 3) mesoscopic, combining aspects of both macro and micro models.

Various models are presented and exercised in their ability to accurately predict the results of bottlenecks, on-off ramps, and human operators. Model stability, calibration and validation are discussed.

Section III, Applications of Traffic Flow Theory, includes examples ranging from determining traffic states and estimating travel times to determining fuel consumption and vehicle emissions to control theory design for optimization of traffic flow.

I recommend *Traffic Flow Dynamics: Data, Models and Simulation* as a very thorough textbook and reference for those in the transportation sciences field. I especially appreciate the long lists of references and recommended readings as well as the companion, open-source, traffic simulation software, videos and examples.

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