

Mathematics at the heart of next-generation public transport

Public transport systems are the backbone for serving the increasing mobility and logistics needs of modern society. Although the infrastructure is very expensive to maintain and to extend, production planning and control are still performed largely manually, resembling more a custom manufacture than a highly efficient industrial process. To substantially improve capacity utilization and service levels, fundamentally new approaches are needed. This talk will outline current developments towards dynamic integrated capacity management. Mathematics is at the heart of this development, including optimization-based flexible timetabling, fully automatic dispatching and train control, passenger-flow based traffic management, real-time delay prediction, and uncertainty-aware journey planning and routing. While each of these techniques has its own benefits, their joint application in an integrated framework will finally close the process loop between planning and operation, leading to a more precise and dynamically optimized production instead of relying on ample capacity reserves and manual interventions to stabilize the system.

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He holds a diploma degree in Computer Science from the Technical University of Dortmund (1999) and a Ph.D. in Electrical Engineering from ETH Zurich (2003). In 2010 he received the *venia legendi* from the Department of Management, Economics, and Technology of ETH Zurich for his habilitation thesis on operations management in complex infrastructure networks and maintains an external lecturer appointment at ETH since then.

His current work focuses on fundamental research in transportation systems and on developing new industry solutions for operations planning and real-time management of public transportation networks. He advises and works in projects with major European railway companies as well as public transport operators worldwide.