

Nonlinear optimal control applied to coordinated ramp metering

Kotsialos, A. Papageorgiou, M.
Dynamic Syst. & Simulation Lab., Tech. Univ. of Crete, Chania, Greece;

This paper appears in: **Control Systems Technology, IEEE Transactions on**

Publication Date: Nov. 2004

Volume: 12, Issue: 6

On page(s): 920- 933

ISSN: 1063-6536

INSPEC Accession Number: 8158142

Digital Object Identifier: 10.1109/TCST.2004.833406

Posted online: 2004-10-25 13:39:27.0

Abstract

The goal of this paper is to describe a generic approach to the problem of optimal coordinated ramp metering control in large-scale motorway networks. In this approach, the traffic flow process is macroscopically modeled by use of a second-order macroscopic traffic flow model. The overall problem of coordinated ramp metering is formulated as a constrained discrete-time nonlinear optimal control problem, and a feasible-direction nonlinear optimization algorithm is employed for its numerical solution. The control strategy's efficiency is demonstrated through its application to the 32-km Amsterdam ring road. A number of adequately chosen scenarios along with a thorough analysis, interpretation, and suitable visualization of the obtained results provides a basis for the better understanding of some complex interrelationships of partially conflicting performance criteria. More precisely, the strategy's efficiency and equity properties as well as their tradeoff are studied and their partially competitive behavior is discussed. The results of the presented approach are very promising and demonstrate the efficiency of the optimal control methodology for motorway traffic control problems.