The Netherlands Research School for Transport, Infrastructure and Logistics

TRAIL

DYNAMIC EQUILIBRIUM ASSIGNMENT CONVERGENCE BY EN-ROUTE FLOW SMOOTHING

Adam J Pel, Michiel CJ Bliemer, Serge P Hoogendoorn

Contribution

The study aims at speeding up convergence within an iterative equilibrium framework (using, e.g., MSA), and at the same time solving common problems with gridlocks coherently. Hence, a new procedure is proposed applying en-route rerouting, here also called en-route flow smoothing.

En-route flow smoothing method

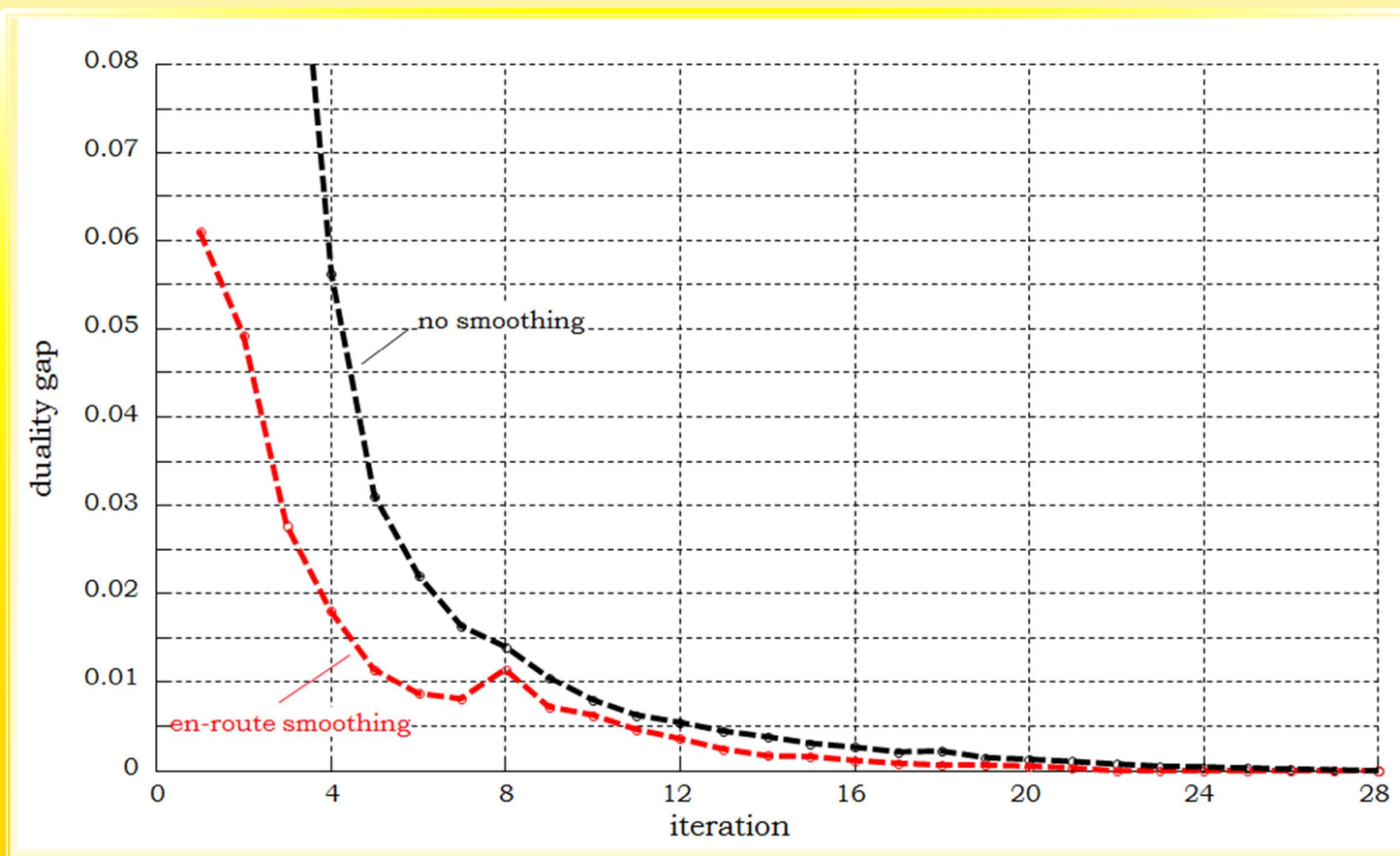
The concept

In short, we enable en-route rerouting in the sense that every intersection provides travellers the possibility to deviate from their pre-trip chosen route when route costs on an alternative route are (sufficiently) smaller. The threshold to reroute increases over successive iterations, thus fading out the effect of en-route flow smoothing, such that in the end the procedure converges to a (pre-trip) dynamic equilibrium state similar to the equilibrium assignment computed by alternative convergence procedures.

The benefits

Gridlocks; When gridlocks (are about to) occur, (real-time) travel times increase on these road sections and travellers are rerouted thereby resolving the gridlock conditions. The DTA model is not halted and travel times can be computed.

Convergence; Route flows are smoothed during simulation. This helps (in early iterations) to compute route travel times which are closer to the travel times emerging under equilibrium conditions, thereby speeding up the convergence.



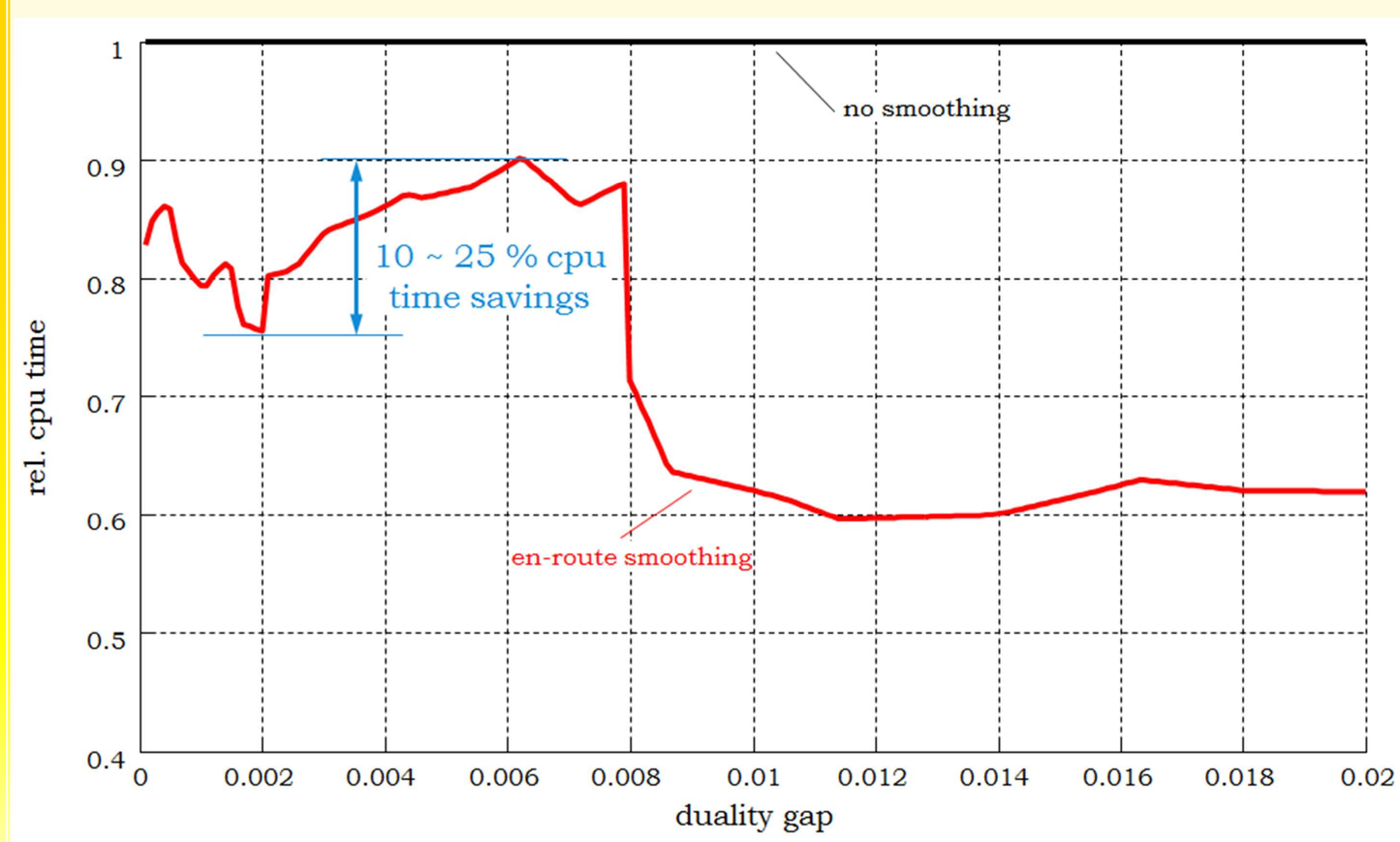
Evolution of duality gap by iteration

Results & Discussion

The Sioux Falls road network was used to test en-route flow smoothing against no smoothing.

Gridlock-like problems in no smoothing case required ad hoc solution to ensure minimum traffic flow, slowing down simulation and yielding underestimated travel times affecting convergence rate.

In the benchmark application, en-route flow smoothing yields a reduction of 10 to 25 per cent of computation time (for lower duality gaps, and up to 40 per cent reduction in case slightly higher duality gaps are accepted).



Relative computation time for various duality gaps
(traditional MSA set to 1)

Delft University of Technology

Contact information:

Adam Pel, **E:** a.j.pel@tudelft.nl, **T:** +31 152 784 997

UNIVERSITY OF TWENTE.

Erasmus University Rotterdam

TU/e Technische Universiteit Eindhoven University of Technology

Radboud University Nijmegen