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Highway toll pricing. (English) [Zbl 1253.91015](#)
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Summary: For a tolled highway where consecutive segments allow vehicles to enter and exit unrestrictedly, we propose a simple toll pricing method. It is shown that the method is the unique method satisfying the classical axioms of Additivity and Dummy in the cost sharing literature, and the axioms of Toll Upper Bound for Local Traffic and Routing-proofness. We also show that the toll pricing method is the only method satisfying Routing-proofness Axiom and Cost Recovery Axiom. The main axiom in the characterizations is Routing-proofness which says that no vehicle can reduce its toll charges by exiting and re-entering intermediately. In the special case when there is only one unit of traffic (vehicle) for each (feasible) pair of entrance and exit, we show that our toll pricing method is the Shapley value of an associated game to the problem. In the case when there is one unit of traffic entering at each entrance but they all exit at the last exit, our toll pricing method coincides with the well-known airport landing fee solution—the Sequential Equal Contribution rule of *S. C. Littlechild* and *G. Owen* [*Manage. Sci.*, Theory 20, 370–372 (1973; [Zbl 0307.90095](#))].

MSC:

[91A12](#) Cooperative games
[90B10](#) Deterministic network models in operations research

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