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GIS-Based Topographical Network for Minimum “Exertion” Routing

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Abstract : The problem of minimum cost routing has been extensively explored in a variety of contexts. While there is a prevalence of routing applications based on least distance, time, and related attributes, exertion-based routing has remained relatively unexplored. In particular, the network structures traditionally used to construct minimum cost paths are not suited to representing exertion or finding paths of least exertion based on road gradient. In this paper, we introduce a topographical network or “topograph” that enables minimum cost routing based on the exertion metric on each arc in a given road network as it is related to changes in road gradient. We describe an algorithm for topograph construction and present the implementation of the topograph on a road network of the state of California with ~22 million nodes.

Keywords : topograph, RPE, routing, GIS
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