

Smart traffic-scenario compressor for the efficient electrical simulation of mass transit systems

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Abstract— The electrical infrastructure of DC-electrified mass transit systems (MTSs) is currently under review. The improvement of MTS infrastructure is commonly tackled by means of optimisation studies. These optimisers usually take large times to obtain their solutions, mainly due to the traffic scenarios that must be taken into account.

The optimisation time may be reduced by increasing the sampling time used to obtain the traffic scenarios. However, due to the fast acceleration and braking cycles in MTSs, it is not clear to which extent the sampling time may be increased. In the majority of cases, this parameter is simply set to 1 s.

To tackle this concern, this paper presents a compression algorithm which makes it possible to thoroughly reduce the number of snapshots to be included in a given traffic scenario with good energy-saving accuracy figures. The traffic-scenario compressor presented is performed in two stages: a first step finds clusters of similar snapshots in the uncompressed traffic scenario; then a second stage searches for a specific set of trains' positions and powers that may be directly included in the traffic model used in the optimisation study.

The results obtained have shown that the compressor makes it possible to obtain an 80% optimisation-time reduction for a given traffic scenario with a total energy-saving error lower than 5%.

Index Terms— Railway power supply system; Railway traffic scenarios; Railway infrastructure optimisation; Railway simulation

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