

OPTIMIZATION OF SPEED PROFILE AND QUICK CHARGING OF A CATENARY FREE TRAIN WITH ON-BOARD ENERGY STORAGE

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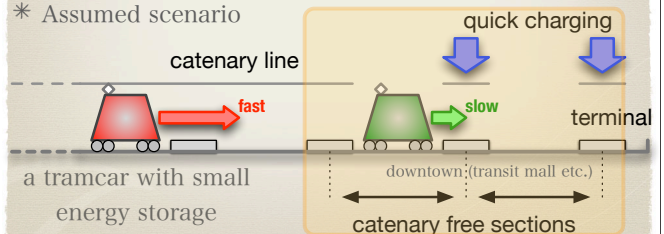
INTRODUCTION

Background

- * Application of energy storage devices to railway
- * It enables effective use of regenerative energy.
- * Some attempts for energy storage on-board can be seen.

Objective

- * Eco-driving and charging on the catenary-free sections
- * **saving energy**
- * smaller storage capacity
- * Assumed scenario

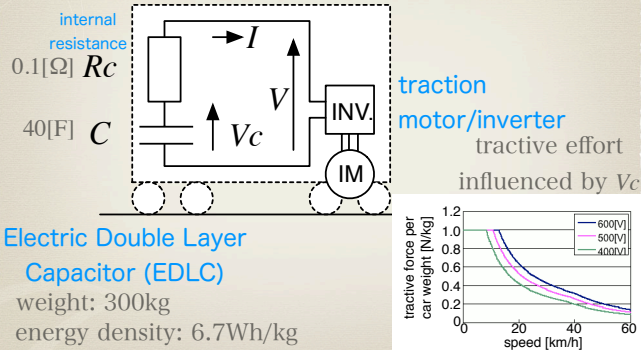


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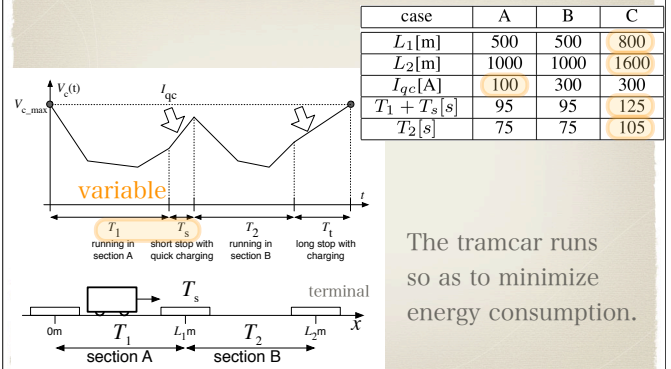
- Introduction
- Modeling
 - main circuit
 - track profile
 - numerical optimization
- Results of simulations
- Conclusion

MATHEMATICAL MODELING

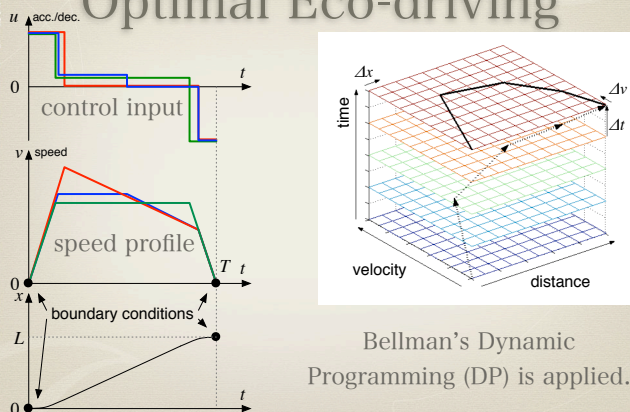
Main Circuit



Track Conditions



Optimal Eco-driving

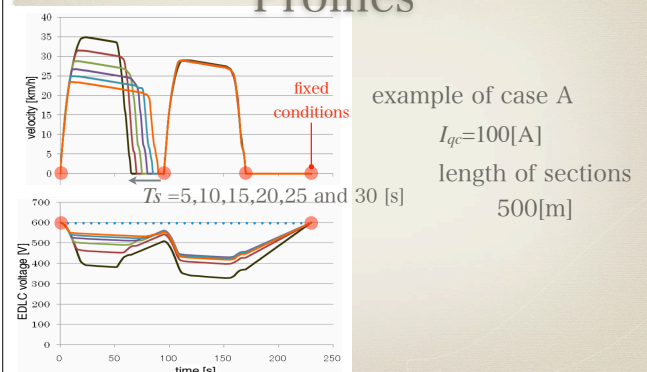


Strategy for Quick Charging

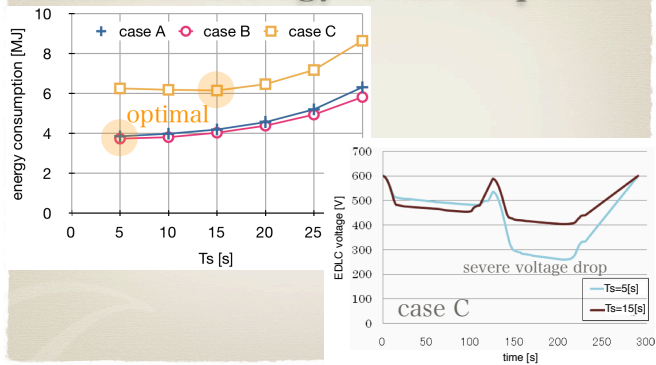
- * charging current
- * larger current
- * larger loss
- * easier driving with higher SOC
- * charging time = stopping time
- * long charging time
- * shorter running time with higher SOC

RESULTS OF SIMULATIONS

Speed and Voltage Profiles



Relation between Charging Time & Energy Consumption



CONCLUSIONS

Conclusion

- * Summary
 - * The rational train speed profile and quick-charging time and current can be discussed with the proposed optimization model.
- * Future scope
 - * analyses under various conditions
 - * system implementation