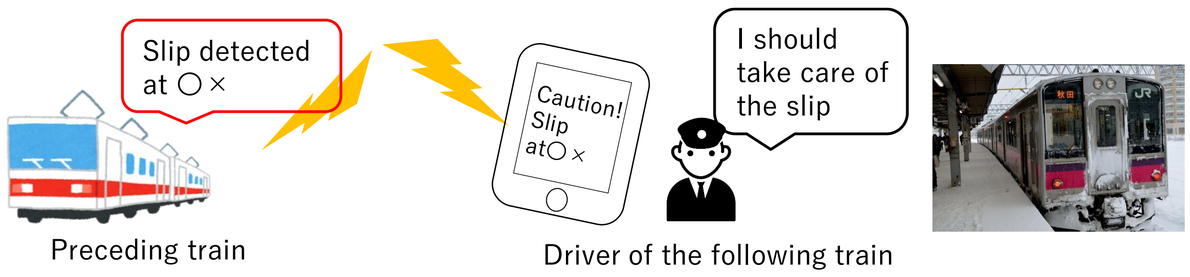
Decreased Deceleration Detection of Railway Vehicle

Partner: East Japan Railway Company

Introduction

When decreased deceleration between a rail and a wheel occurs, the braking distance is extended, which demands caution by a driver. In particular, the decreased deceleration occurs more frequently in snow weather. The purpose of this study is to detect decreased deceleration and share the detection information among vehicle drivers in order to prevent unsafe operation.

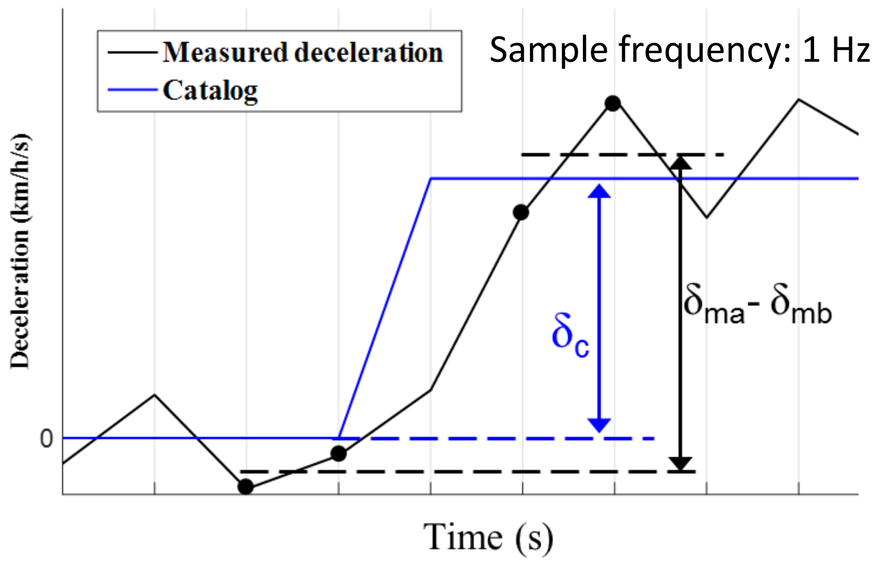


Method

The decreased deceleration is detected by comparing the measured deceleration with the designed catalog deceleration with the following algorithms. namely Pattern A and Pattern B.

Detected if $(\delta_{ma}-\delta_{mb})/\delta_c < PatternA_{TH}$

Value of Pattern A = $(\delta_{ma}-\delta_{mb})/\delta_c$

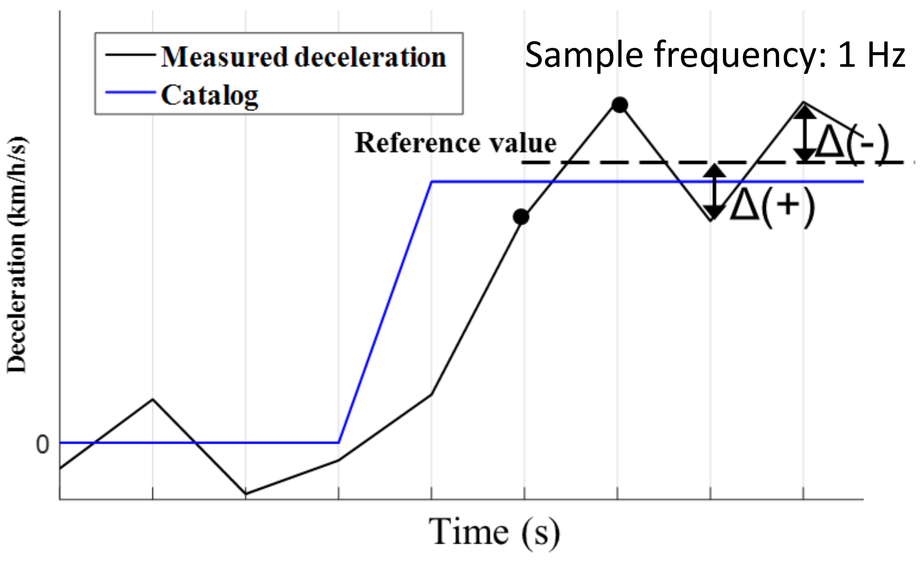


Algorithm to calculate the value of Pattern A

δ_{mb} was the average value of two samples before the notch changes. δ_{ma} was the average value of two samples after the notch changes. The transition time was considered and set as 2 seconds.

Detected if $\Delta > PatternB_{TH}$

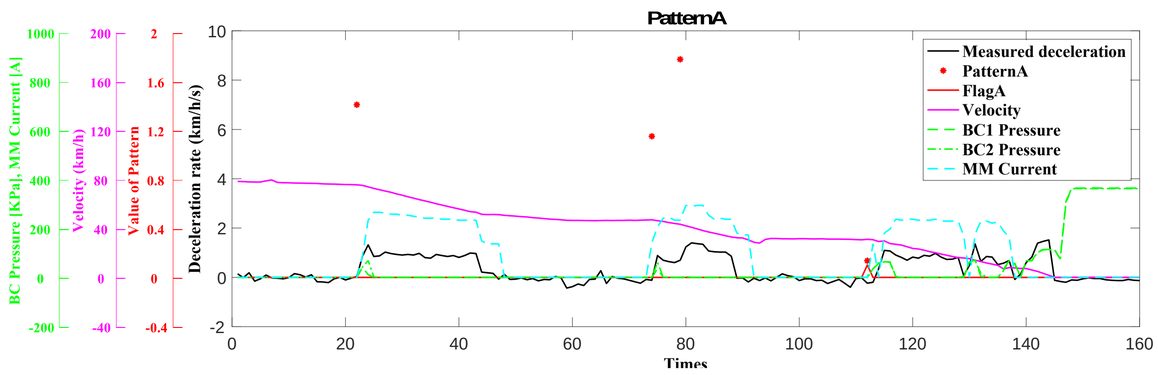
Value of Pattern B = Δ



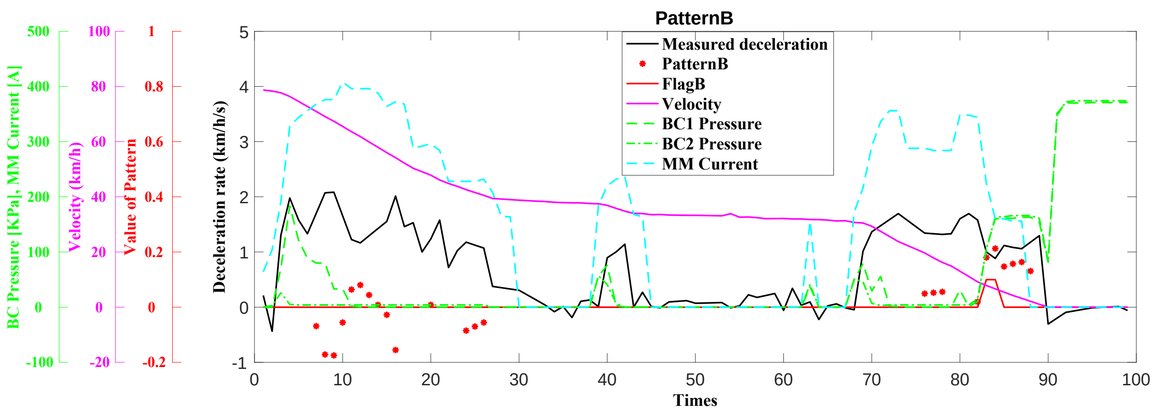
Algorithm to calculate the value of Pattern B

The reference value was the average value of two samples after the notch changes. The transition time was considered and set as 2 seconds.

Off-line detection Results



Detection of Pattern A, shown as Flag A (Data: 20170305 08:51 Hirosaki) .

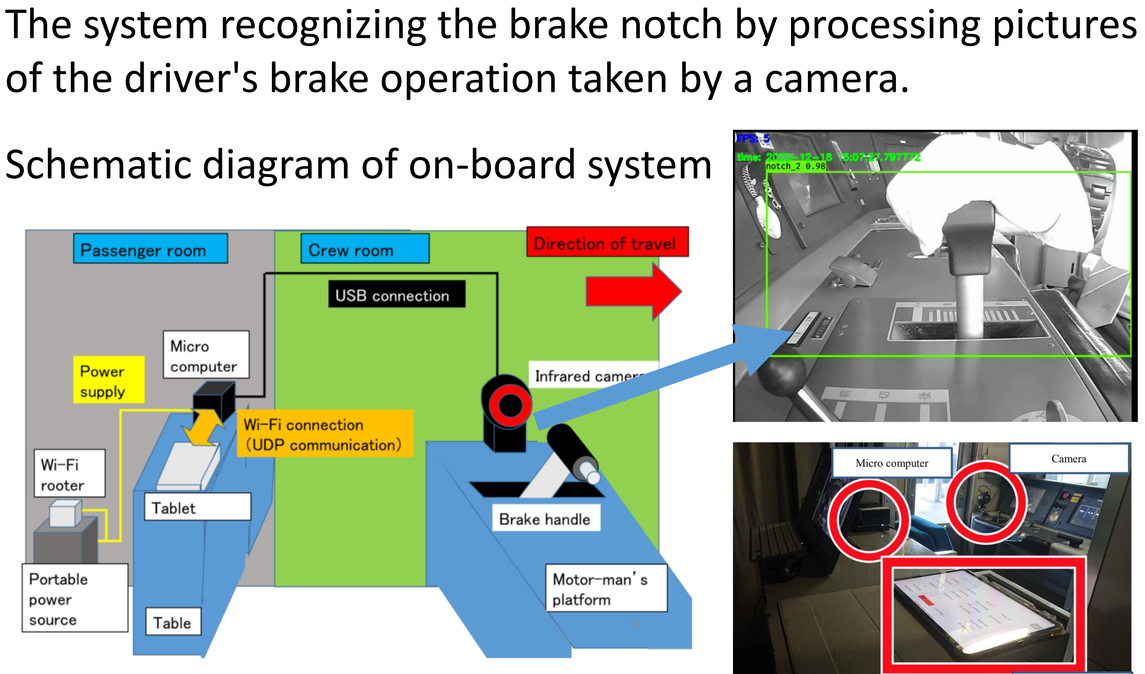


Detection of Pattern B, shown as Flag B (Data: 20170210 18:07 Tsurudomari).

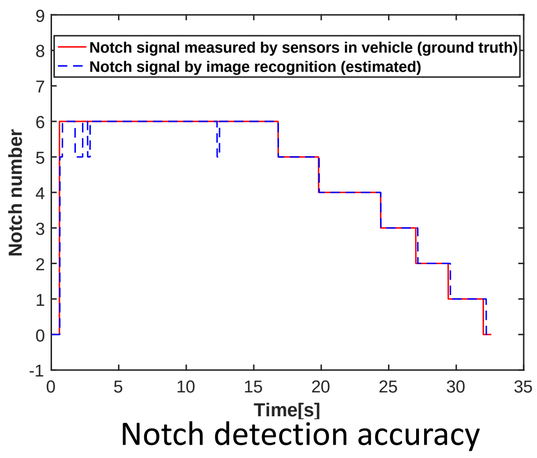
On-board system

The system recognizing the brake notch by processing pictures of the driver's brake operation taken by a camera.

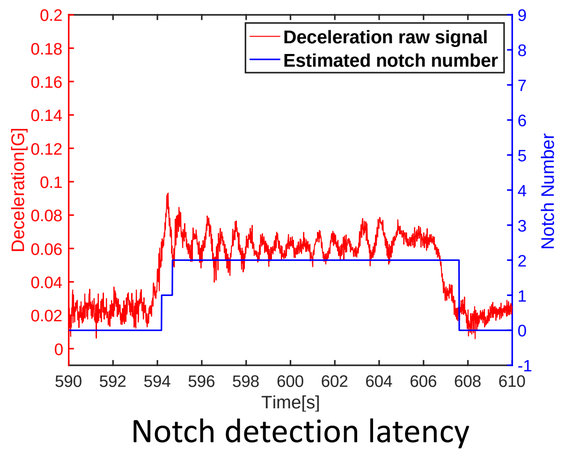
Schematic diagram of on-board system



Results of the detection



Notch detection accuracy



Notch detection latency

Conclusion

- An algorithm used for detecting decreased deceleration information in the snow condition is proposed, and the off-line detection results prove its effectiveness.
- An on-board detection system of brake notch is developed with good detection speed and accuracy.

Publications

Z. Wang, K. Saito, H. Iijima, T. Kaizuka, and K. Nakano, “Decreased Deceleration Detection of Railway Vehicle in the Snow Condition”, *Proc. of J-Rail 2019*, JSCE.

Z. Wang, T. Fujita, K. Matsuhashi, T. Shinohara, H. Hata, B. Yang, and K. Nakano, "On-board Monitoring System for Decreased Deceleration Detection of Railway Vehicle", *STECH 2021*, Chiba, Japan, Nov. 2021.