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Real Time Detection of Low Adhesion in the Wheel/Rail Contact

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“Real Time Detection of Low-Adhesion in the Wheel Rail Contact”
What is low adhesion?

- Braking relies on contact friction
- Reduced by
  - Leaf contaminant
  - Rain and ice
  - Oil contaminant
  - ‘Micro-wetting’
- SPADs
  - Cat. A ≈300/year
  - Stonegate cl. 375, 8/11/2010
    - Train at 100kph
    - Expected to stop in 1240m
    - Took 5180m, 3940m past the station
Methodology

- Linear Plan-view model
- Form Kalman-Bucy filter
- Estimate Contact Forces
  - (augmented states)
- Use relationships with dynamics to approximate adhesion
Results – Comparison to ‘real’ VAMPIRE data

**F\textsubscript{FF} - Series 1A: Run9**
\[ M = 0.891; P = 0.264; C = 0.930; \]

**F\textsubscript{FR} - Series 1A: Run9**
\[ M = 0.730; P = 0.232; C = 0.766; \]

**M\textsubscript{FF} - Series 1A: Run9**
\[ M = 1.632; P = 0.390; C = 1.678; \]

**M\textsubscript{FR} - Series 1A: Run9**
\[ M = 2.934; P = 0.429; C = 2.966; \]
Results – Comparison to ‘real’ VAMPIRE data

Adhesion Estimation - Series 1A Datasets
RMS window: 5s

\[ \mu = 0.56 \]

\[ \mu = 0.072 \]

\[ \mu = 0.038 \]
Conclusions

- Reasonable approximation of adhesion estimation
  - Direct data methods showing good results too
- Success against ‘Blind Data’
- Progression to track testing – June 2013?