

Experimental Study of Wire Brush Brake Noise on a Personal Car

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Wire Brush Noise (Scratch Noise)

- Disc and pad surface roughness induced, no non-linear feedback
- Broadband
- Low frequency
- Interior noise

Scope of Work

1. Preliminary study of noise phenomenon
 - Understanding of the problem
 - Parameter study, speed and brake pressure
2. Component measurement
 - Brake system vibration study
3. Surface roughness
 - Controlled surfaces
4. Transfer path
 - Correlation study
5. ... Source model

Preliminary Study

Monitored effect of varying

- Brake pressure
- Vehicle speed

Instrumented

- Brake pad (Accelerometer)
- Interior and exterior (Microphones)



Description of Test Rig

Tests rig

- Electrical engine driven rollers
- External brake pump
- Small personal car



Limiting Factors of Test Rig

- Noise Masking
 - Tire-roller noise
 - Roller noise
 - Electrical engine
 - Roller mechanics
 - Background noise

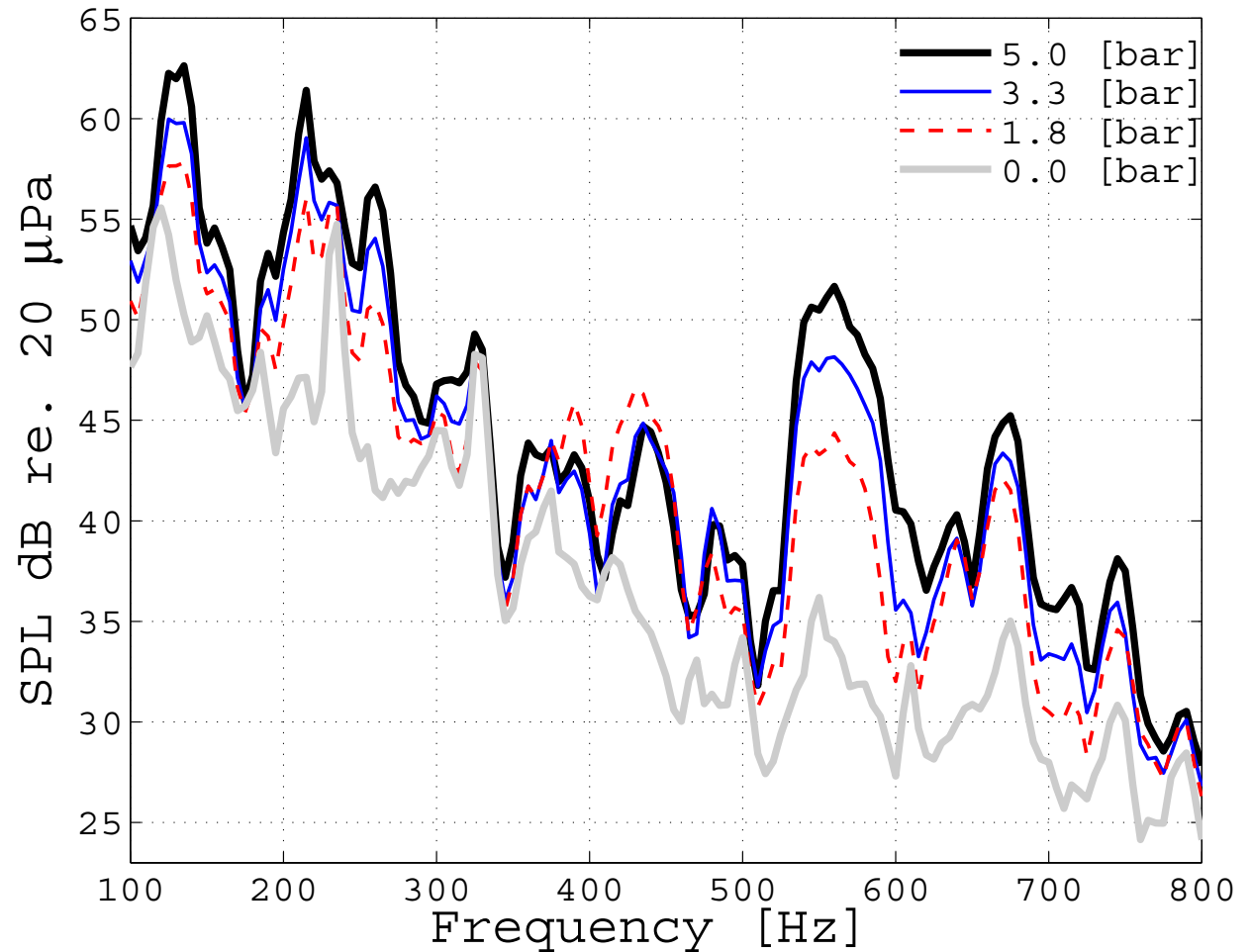


Interior Noise

-Increasing Brake Pressure

- Increasing noise levels with brake pressure
- Broadband
- Low frequency

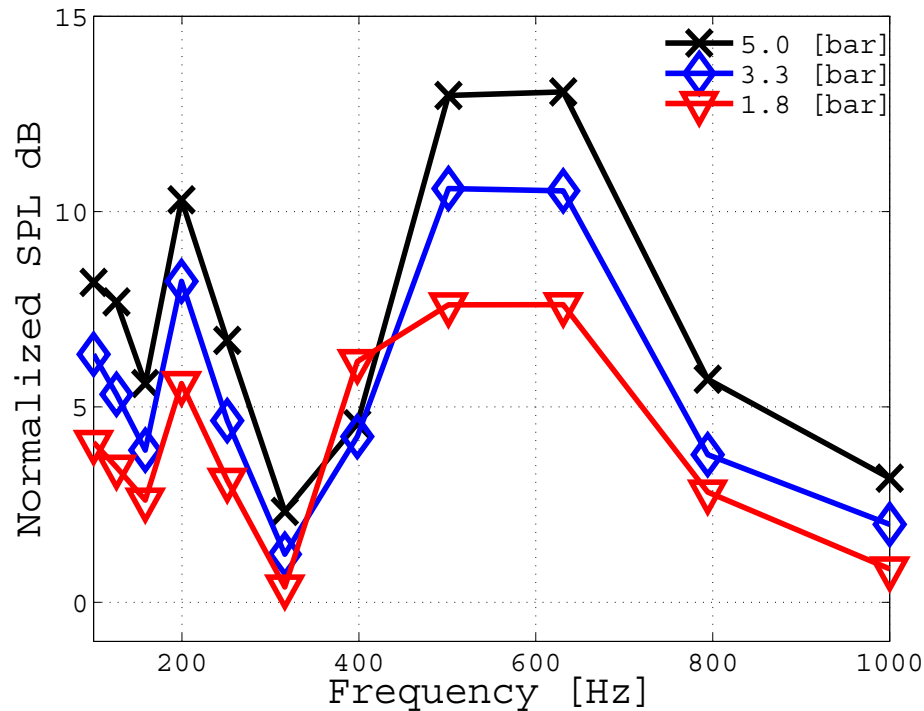
Spectra will be referred to as either “flat” or “oscillating” in frequency, (fig in slide “oscillating”)



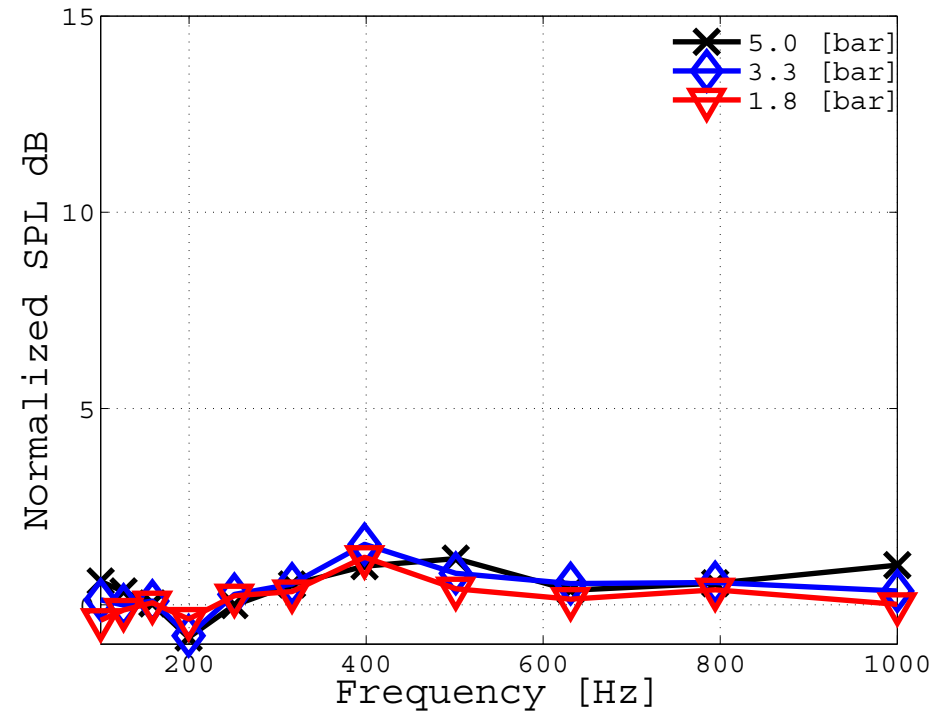
Roller speed, 1.3 [km/h]

Interior and Exterior Noise -Increasing Brake Pressure

Interior



Exterior



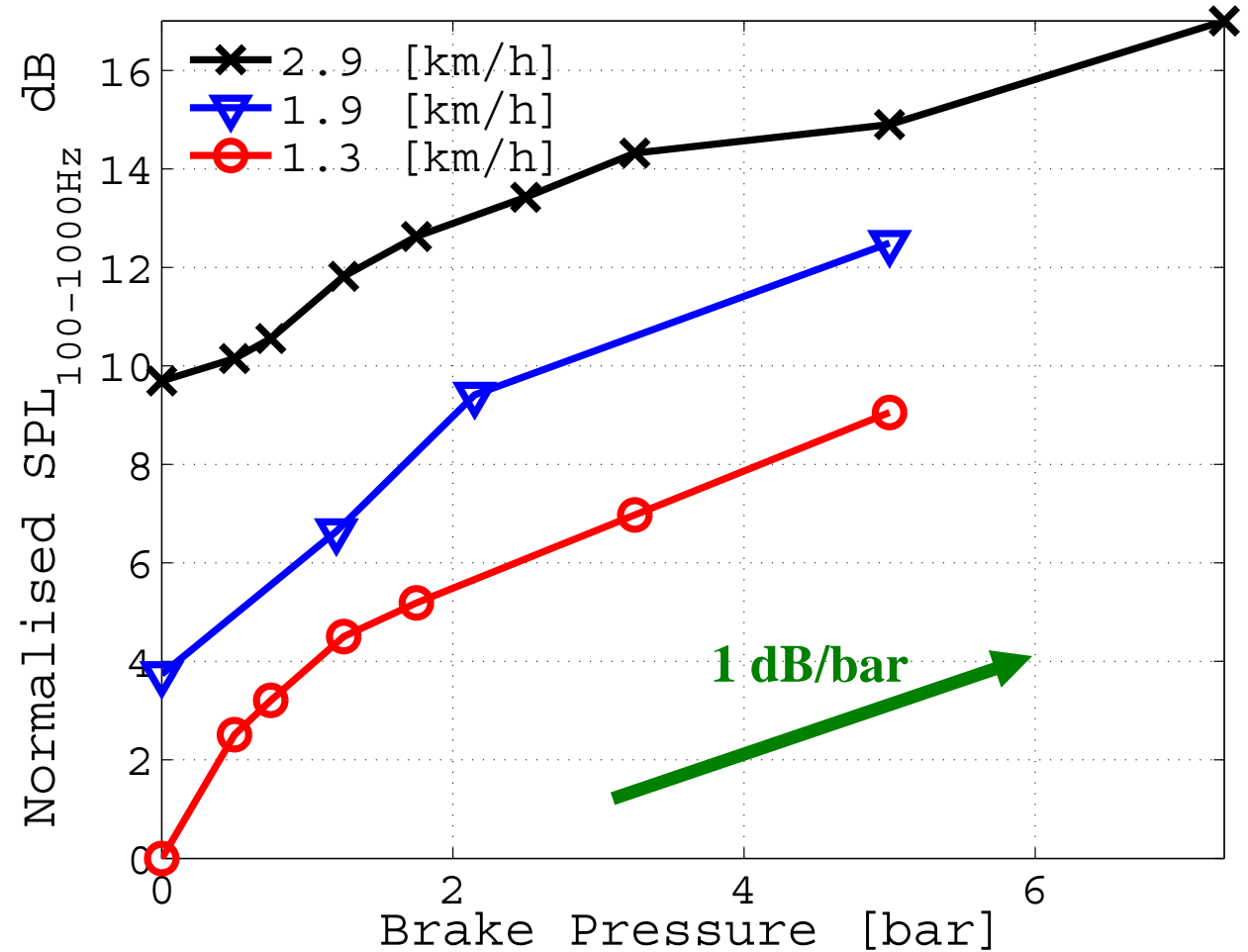
Roller speed, 1.3 [km/h]

- Noise phenomenon present only interiorly

Interior Noise

-Increasing Brake Pressure, Roller Speed

- Increased levels with
 - Brake pressure
 - Roller speed
- Curve almost parallel for all speeds

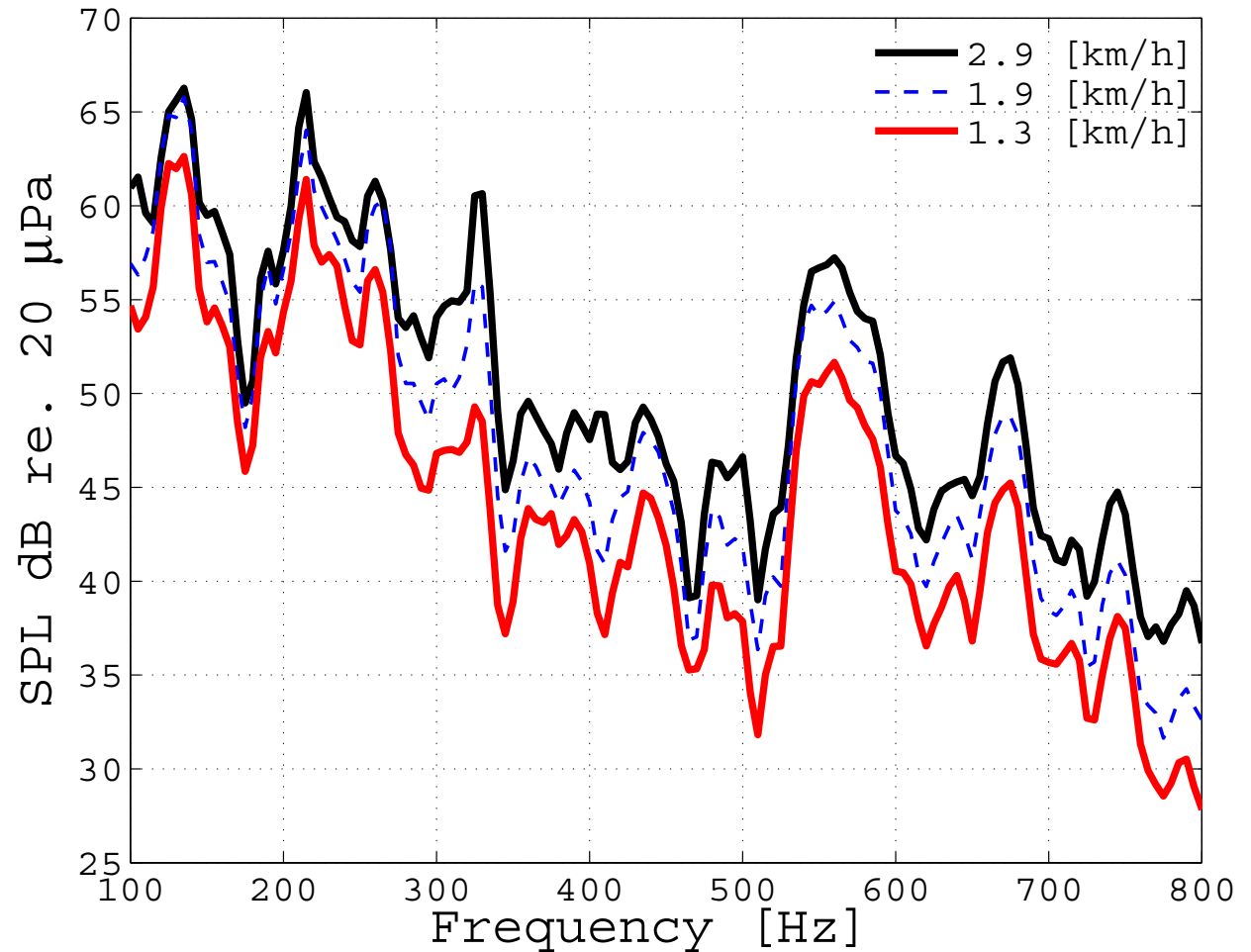


Total level 100-1000 Hz

Interior Noise

-Increasing Roller Speed

- Increased noise levels with increased speed
- Fundamental shape of spectra intact. (“oscillating” frequency response)

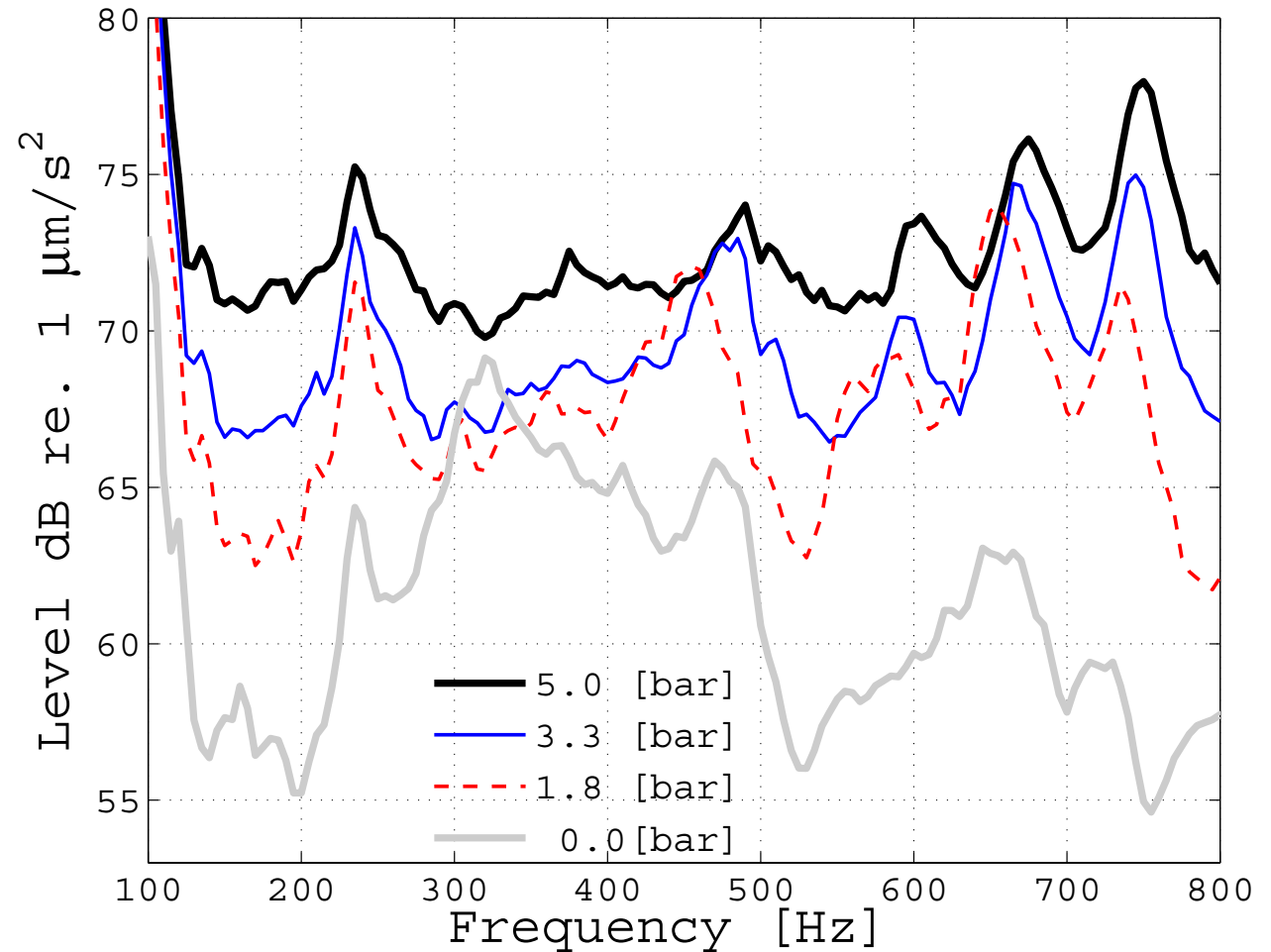


Brake pressure, 5 [bar]

Brake Pad Vibrations

-Increasing brake pressure

- Increased vibration levels with increased brake pressure
- Fundamental shape of spectra NOT intact
 - “Flutter” frequency response
- Peaks shifted up in frequency with increasing brake pressure



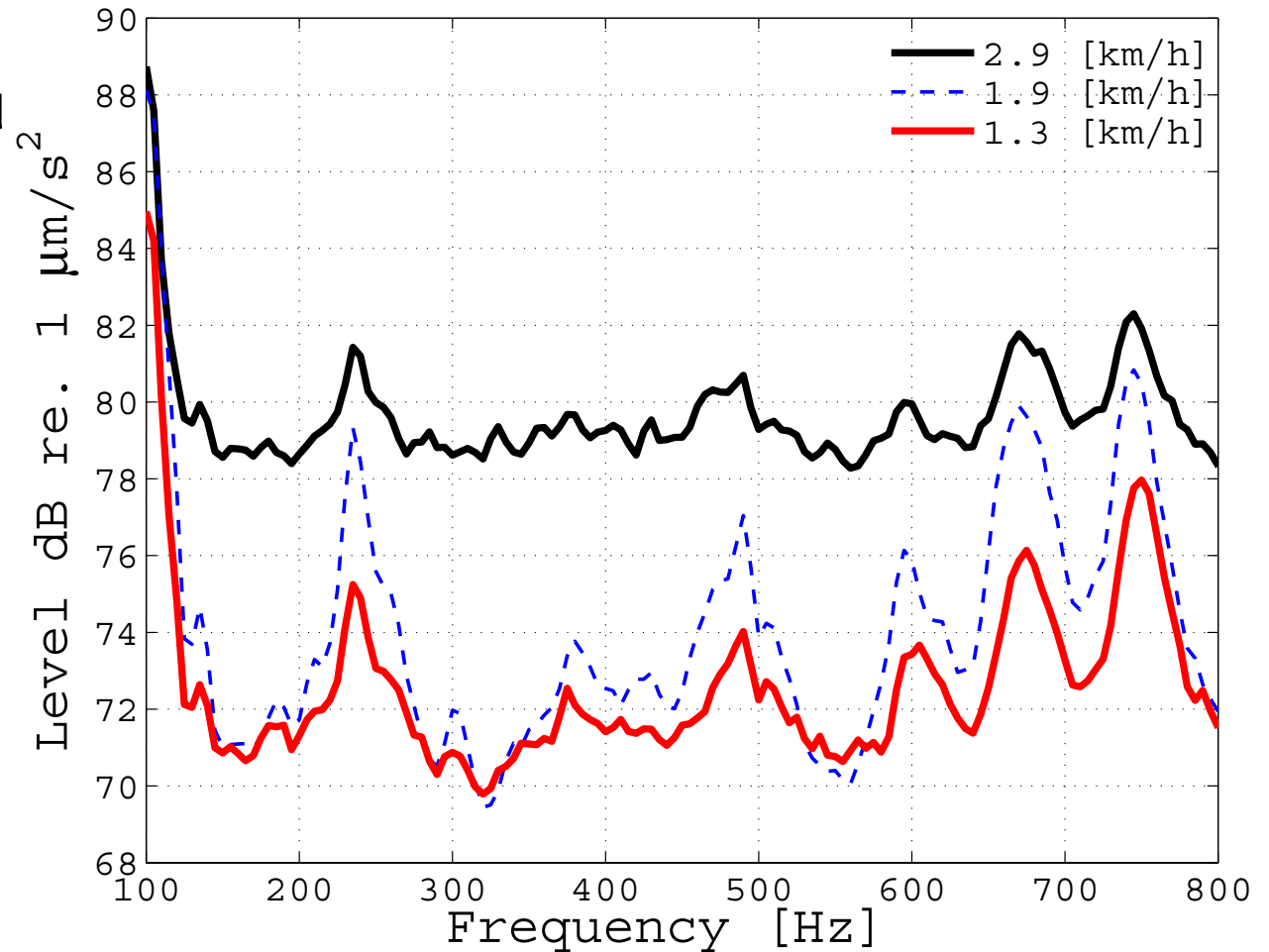
Roller speed, 1.3 [km/h]

Brake Pad Vibrations

-Increasing Roller Speed

- Increased vibration levels with increased roller speed
- Fundamental shape of spectra NOT intact
 - “Flutter” frequency response
- Peaks intact with increasing roller speed

NB! Brake force unchanged (if Coulomb friction)



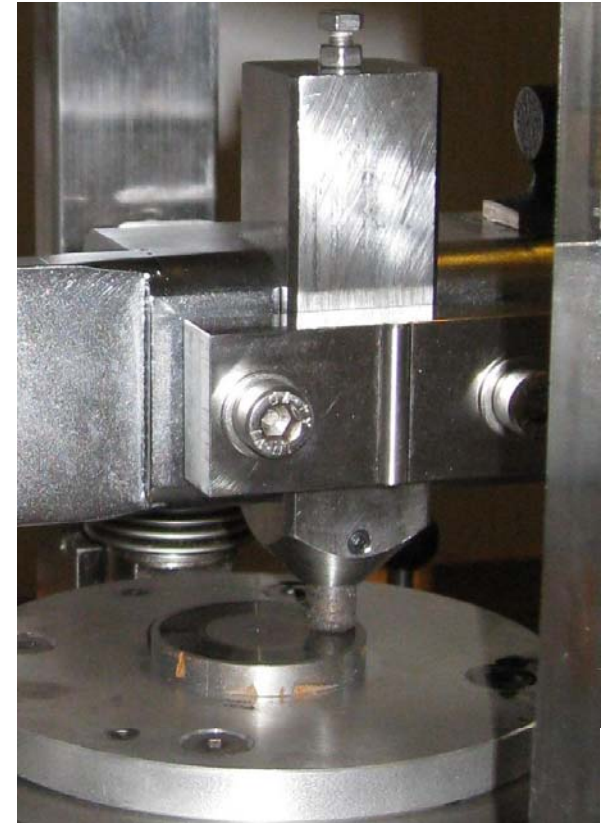
Brake pressure, 5 [bar]

Conclusion

- Noise event can be reproduced in measurement
- Increased brake pressures and roller speed gives
 - Increased interior noise levels
 - Increased pad vibration levels
 - Frequency response shape of pad vibrations change, but fundamental shape of interior noise intact
- Better understanding of transfer path system

Future Work

- Component measurement
- Roughness influence
- Response correlation
- Transfer path
- ...Source model



Questions

Acknowledgment

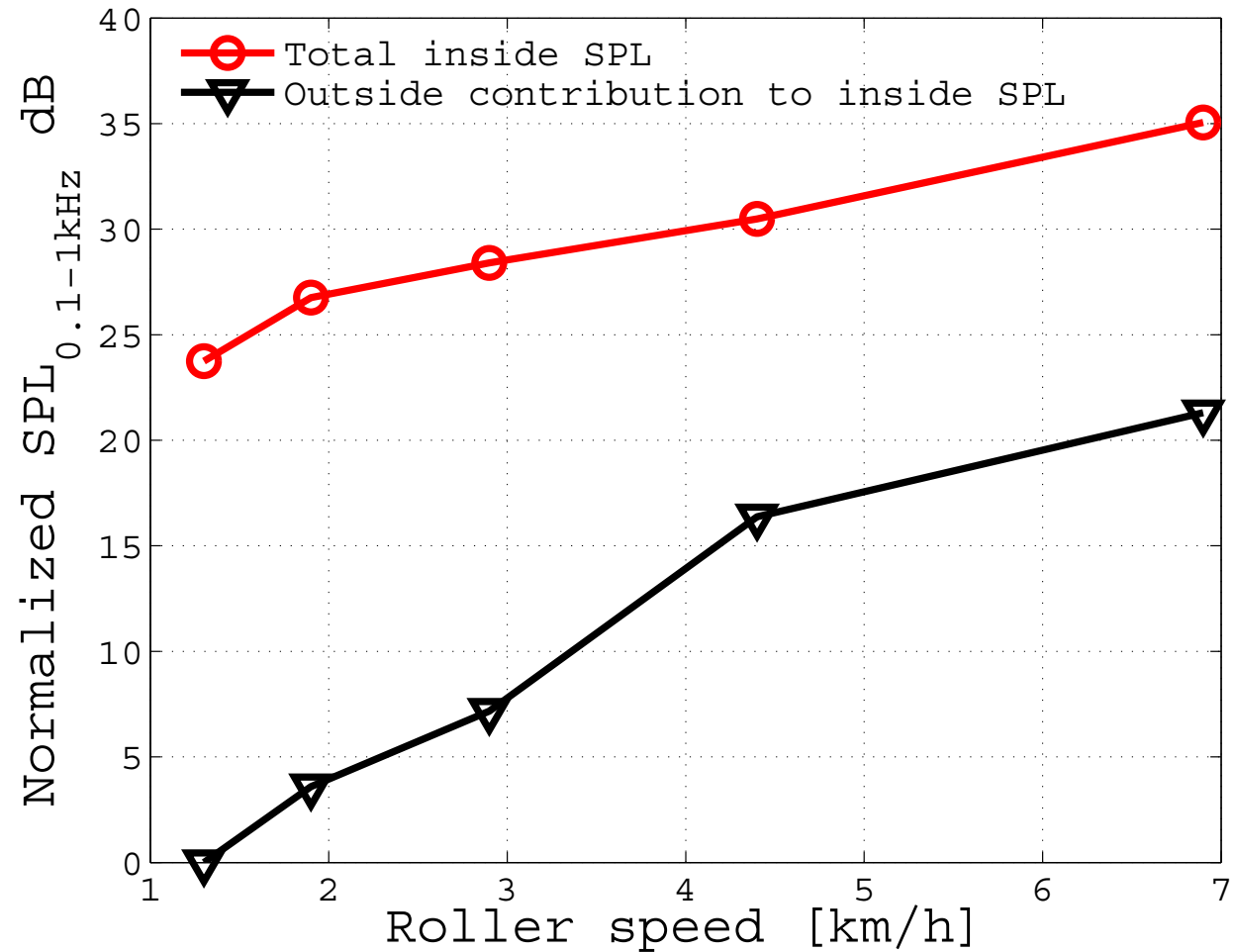
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Interior Noise

-Influence of Exterior Noise

From measured reduction index estimated contribution of the exterior airborne noise to interior total noise



Total level 100-1000 Hz

Brake pressure, 5 [bar]

