Proposal for collaborative Master's Thesis project

Squeal noise on the Stockholm metro – identification of noise sources and statistical analysis of influencing factors

Squeal noise is characterized by large sound pressure levels with components at a few dominating frequencies typically in the range below 10 kHz. For rail vehicles, it is generated during curving (i.e. "curve squeal" or "flanging noise" generated due to excitation by the wheel–rail contact at the low and high rail, respectively) or braking (i.e. either disc- or tread brakes). The construction of track networks in densely populated areas makes solving the squeal noise issue a highly prioritized task for railway networks worldwide. In a previous master's thesis project, the generation of curve squeal on the green line of the Stockholm metro was investigated by means of a statistical assessment based on sound pressure measured during one year of traffic by a metro train instrumented with on-board microphones. An example result obtained with logistic regression analysis of noise data measured in a 120 m radius curve is presented in Figure 1. It illustrates that air humidity has a significant influence on the probability of curve squeal in the current curve.

The investigation sets out by counting all squeal events in the data collected during a year. By identifying individual characteristics of the different types of squeal noise the total number of events are broken down into "curve squeal", "flanging noise" and "brake squeal". A statistical analysis purposed to investigate the influence of operational (e.g. vehicle speed, curve radius, retardation) and environmental conditions (e.g. track constructed in or outside a tunnel, season of the year, temperature, humidity) on the generation of squeal noise is performed. The project is suitable for 1 – 2 persons. Working places will be offered both at Chalmers and the Swedish National Road and Transport Research Institute (VTI) located at Lindholmen.

Contact

Peter Torstensson of VTI, peter.torstensson@vti.se
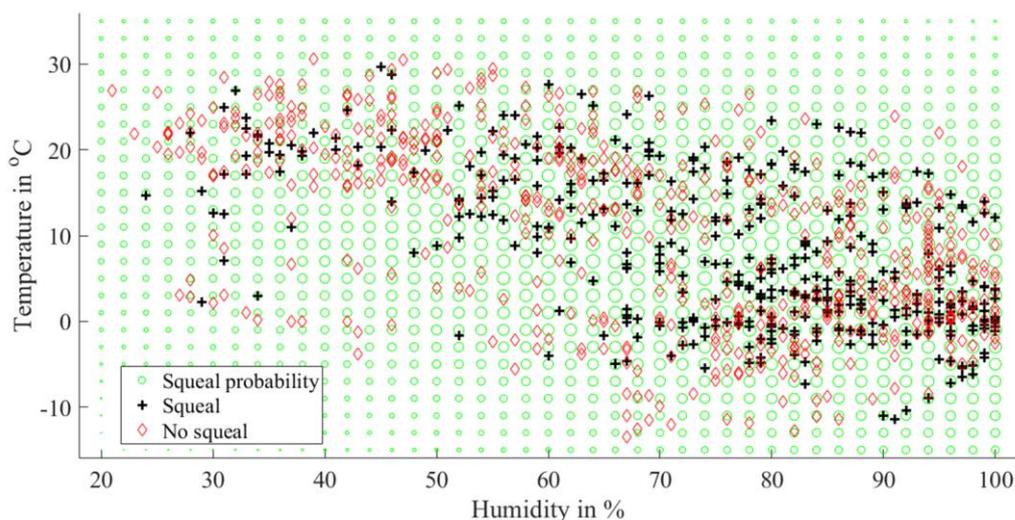Astrid Pieringer of Chalmers University of Technology, astrid.pieringer@chalmers.se

Figure 1. Scatter plot with grid that indicates probability of squeal (green circles) obtained with the logistic regression model developed for data collected on a 122 m radius curve located between stations Alvik and Stora mossen during