

Correlation between Parameters of the Tribosystem and Automotive Disc Brake Squeal

Abstract

The friction coefficient μ and the pad/disc stiffness, perpendicular to the friction force direction, are considered important disc/pad tribosystem parameters for disc brake squeal. μ experimentally proved to have the most single correlation to the brake squeal propensity. The general trend is mainly supported by friction materials, which generate very high μ -values and counter-examples to the general trend exist.

The pad's normal stiffness c is not in-situ measurable with sufficient precision, so a model of c based on compressibility measurements was developed. Using this model a clear trend of an increasing squeal propensity with increasing μ and increasing c can be found.

Linear squeal propensity regression models based on μ and c were built and used to calculate the squeal propensity for each test. The calculated squeal propensities are in a suitable range to reproduce general trends.

Data mapping functions have been used to calculate characteristic values based on μ and c - one per brake application or one per test. The correlation between the squeal propensity and these characteristic values, showed that the measured squeal propensity trends can be maintained throughout data pooling.

To judge the usefulness of the squeal behavior models, a 'Model Quality Rating Measure' was introduced. Using it, one of the best models was based on the percentage of μ -values above 0.5 during the test and on the modeled c with a brake line pressure of 60 bar. This supports the assumption that higher μ -values drastically influence brake squeal and that the squeal propensity is dependent on c .