Article Abstract

Title:	Analysis of disc brake squeal using a ten-degree-of-freedom model
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Abstract:	Disc brake squeal is considered as a highly main source of discomfort for passengers. It is also considered to be a high frequency noise when it is bigger than 1 kHz audible vibration of braking components. It is a significant problem in passenger vehicles that has not been solved satisfactorily until recently. Many manufacturers of brake pad materials spend up to fifty percent of their engineering budgets on noise, vibration and harshness (NVH) issues. Squeal noise is strongly correlated to the squeal index and degree of instability of the brake system assembly. Decreasing this squeal noise to some extent during braking is a very important matter for the comfort of passengers. So, a mathematical prediction model of 10-degree-of-freedom has been developed to study the effect of different brake components parameters on the degree of instability and squeal index of the brake system. The model has considered such factors as the distance between clamping bolts of the caliper, width and thickness of the friction material, which were not fully covered previously besides some other factors. Complex eigenvalue analysis by analytical program has been used to predict the unstable frequencies in the ventilated disc brake system assembly. It is evident from the analysis that Young's moduli of the rotor and friction material have a great effect on the occurrence of squeal. The harder the friction material the bias of the brake to squeal. It is shown also that the squeal noise of the brake decreases with increasing semi-distance between the clamping bolts of the caliper to be at optimum value between 50-70 mm. However increasing the friction material thickness to 11 mm decreases the squeal index and instability of the system. The results have show that the predicted squeal tendency at varying all the studies parameters is as less as possible to be 43 % compared to other single parameters.
Keywords:	Ventilated disc brake, brake squeal, squeal index, degree of instability, eigen frequency.