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Sensitivity analysis for a single-shoe drums brake

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Drum brakes have dominated the braking industry for many years, and will most likely continue to do so for the foreseeable future due to their low cost and adequate operating performance. Basic equations for designing these brakes have been presented in college textbooks, while complicated analysis has been published using finite element methods to predict brake squeal and instability. This paper seeks to step away from the complexity of numerical models to consider the fundamental braking phenomenon of a single-shoe drum brake, using no dimensional, closed-form analysis and a Taylor series expansion to examine the effects of perturbing dimensionless design parameters. In conclusion this paper shows that the braking torque is dependent upon only four dimensionless groups, and that two of these groups dominate the physics of braking. Furthermore, it is shown that adjustments to these two dominating groups have a direct impact on the contact pressure between that shoe material and the brake drum, and that this pressure must be kept below the yield strength of the braking material in order to prevent a mechanical failure of the brake. Since the results are no dimensional, they are generally applicable to all single-shoe drum brakes having a design with mechanical features that are similar to the one analyzed in this paper. Taguchi optimization method is used to find the optimum design of that brake using largest the best of quality loss function.

Biography

Salwan Waheed served as Assistant Professor in Mechanical Engineering at Babylon University, Iraq and currently pursuing his PhD at University of Missouri, Columbia.

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