



# Mechanical Engineering Colloquium

December 5<sup>th</sup>, 2014

**Macdonald Engineering Building (MD) 267 from 11 - 12 pm**

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**APC project: Design and Optimization of the Powertrains for the  
Electric Vehicles**

**Abstract:**

The project of McGill University and Automotive Partnership Canada "Development of Optimal Multi-Speed Electric Drive Trains" has started in 2012 and involves the team of seven professors from the Faculty of Engineering and nearly 40 research engineers, postdocs and students. An overview of the projects of the Design Team is given.

An approach to the design, development and optimization of a multi-speed transmission for the electric vehicles is described. Two main directions of research can be formulated here. In the first, the overall optimization of the transmission geometry and speed parameters is considered. Special attention is focused on the use of a two-speed transmission in electric delivery step vans to improve performance and efficiency. Main tasks relating to this application are considered. The first task includes the development and optimization of a two-speed transmission, where the gear ratios are used as design variables, while vehicle performance and energy consumption are design objectives. The procedure is based on the combined simulation and optimization. The second task includes the estimation of the efficiency and comparison of the performance of an electric step van with a direct drive setup versus the vehicle with the two-speed transmission.

In the second stream of research, the concept of the gear geometry optimization is proposed, namely, design of the gear tooth-root profile using cubic splines, aiming to investigate the effects of tooth-root geometry on stress concentration and increase the gear tooth strength by optimizing the root profile. This showcases an innovative methodology for the design of the tooth-root profile to increase gear load-carrying capacity.