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Mini Baja CVT Optimization

Emily Masa
eam134@zips.uakron.edu

Alec Bagley
ajb267@zips.uakron.edu

Kyle Fertig
kvf1@zips.uakron.edu

David Gao
dwg17@zips.uakron.edu

Noah Cook
njc60@zips.uakron.edu

Senior Design Project

Baja eCVT

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By:

Alec Bagley
Noah Cook
Kyle Fertig
David Gao
Emily Masa

Abstract

The purpose of this senior design project was to determine the viability of an electronic continuously variable transmission (eCVT) design as an alternative to the traditional centrifugal CVT currently used on The University of Akron's Zips Baja SAE car. The goal was to design and optimize an eCVT setup and then compare its acceleration performance to a tuned centrifugal CVT to determine if it would be an improvement over the design team's current CVT setup. A CVT provides an advantage over a traditional transmission by producing an infinite number of gear ratios through the use of v-shaped sheaves which moves closer and farther apart with a V-belt between them. An optimized CVT attempts to keep a fully open engine RPM constant throughout acceleration where power is maximum. An eCVT has the potential to be an improvement over a traditional CVT by changing the distance of the sheaves directly based on engine RPM feedback instead of relying on a series of weights and springs which attempt to match the engine curve.

A three designs were considered in order to achieve these goals using a linear actuator and hall effect sensor. A mechanical connection between the actuator and a bearing on the inner sheave, a roller mechanism pushing against the inner sheave, and a hydraulic throwout bearing design was considered. It was decided that the mechanical connection was the best choice, and paired with an Arduino interface, code was developed to monitor the engine rpm and control the actuator position based on this data.

Acknowledgements

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- Dr. Christopher Daniels is our advisor and has provided guidance where necessary in order to keep this project moving despite COVID-19 limitations.
- Bill Wenzel provided positive criticism to the design based on his decades of machining experience in order to make the project machinable at the university and work as intended. He also supported the machining of the parts.
- Trent Bolek and Alex Rawson wrote the G-code necessary in order to CNC the actuator adaptor and ran the program on the CNC.
- Mark Masa wrote the G-code necessary in order to CNC the sheaves and ran the program on his CNC lathe.
- The *Science Fun* YouTube channel provided understandable videos that were used to support the writing of the Arduino code. Email correspondence with the creator of the channel helped solve numerous errors in our written code.
- Clinton Aluminum donated the 7075 aluminum that was necessary to machine most of the components of the eCVT.