

PERFORMING TRANSIENT VIBROACOUSTIC ANALYSIS ON A CONTINUOUSLY VARIABLE TRANSMISSION USING A VOLD-KALMAN FILTER

EL Mehdi Mojab¹, Philippe Micheau^{1,2}, Maxime Boisvert^{1,3}

¹University of Sherbrooke, Departement of Mechanical Engineering, Sherbrooke, Canada

²University of Sherbrooke, CRASH-UdS, Sherbrooke, Canada

³University of Sherbrooke, Advanced technology center, Sherbrooke, Canada

ABSTRACT

A continuously variable transmission (CVT) is a type of automatic transmission system that uses belts and pulleys to provide an infinite number of gear ratios. The system consists of two pulleys: a primary drive pulley and a secondary drive pulley, each with a fixed and a moving sheave. In snowmobiles, the primary pulley is connected to the crankshaft of a two-stroke engine, while the secondary pulley is connected to the track element. The use of a two-stroke combustion engine can cause torque fluctuations to propagate through the crankshaft to the CVT, resulting in excessive vibration and noise levels. To evaluate the vibroacoustic emissions of CVTs, alternative methods have been developed due to the limitations of road noise testing. One such method is to use an adaptive controller on a dynamometer to perform a repeatable acceleration phase, allowing for efficient and sophisticated acoustic analysis. Vold-Kalman order tracking (VKF-OT) with a phase-locked loop (PLL) is used to analyze the non-stationary periodic components of the noise generated by the CVT. This study conducted dynamometer experiments to identify the noise generated by the CVT during the acceleration phase. However, the analysis of the acoustic data can be difficult due to the lack of repeatability of the speed ramps during dynamometer tests. To solve this problem, post-processing methods have been proposed to synchronize the acoustic measurements taken at different speed ramps. The objective is to develop an adaptive approach to identify the prominent noise order, allowing a comparison of vibroacoustic performance between different CVT designs. Experimental results demonstrated the effectiveness of this experimental tool to analyze the attenuation of certain low order intensities during the acceleration phase.

Keywords: CVT, two-stroke engine, vibroacoustic, acoustic signal, VKF-OT, PLL