ABSTRACT

Klop, Richard James. Ph.D., Purdue University, December, 2010. Investigation of Hydraulic Transmission Noise Sources. Major Professor: Dr. Monika Ivantysynova.

Advanced hydrostatic transmissions and hydraulic hybrids show potential in new market segments such as commercial vehicles and passenger cars. Such new applications regard low noise generation as a high priority, thus, demanding new quiet hydrostatic transmission designs. In this thesis, the aim is to investigate noise sources of hydrostatic transmissions to discover strategies for designing compact and quiet solutions.

A model has been developed to capture the interaction of a pump and motor working in a hydrostatic transmission and to predict overall noise sources. This model allows a designer to compare noise sources for various configurations and to design compact and inherently quiet solutions. The model describes dynamics of the system by coupling lumped parameter pump and motor models with a one-dimensional unsteady compressible transmission line model.

The model has been verified with dynamic pressure measurements in the line over a wide operating range for several system structures. Simulation studies were performed illustrating sensitivities of several design variables and the potential of the model to design transmissions with minimal noise sources.

A semi-anechoic chamber has been designed and constructed suitable for sound intensity measurements that can be used to derive sound power. Measurements proved the potential to reduce audible noise by predicting and reducing both noise sources. Sound power measurements were conducted on a series hybrid transmission test bench to validate the model and compare predicted noise sources with sound power.