The Centre for Power Transmission and Motion Control

UNIVERSITY OF BATH

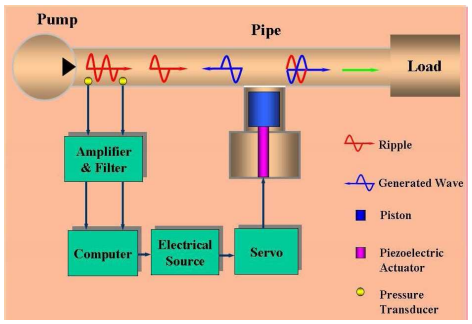
Research Project

ACTIVE CONTROL OF FLUID BORNE NOISE

Motivation

Fluid-borne noise (FBN) is caused primarily by unsteady flow from pumps and motors. It takes the form of pressure ripples or fluctuations in the fluid, resulting in structure-borne noise and air-borne noise. The attenuation of FBN has a significant effect on the hydraulic system.

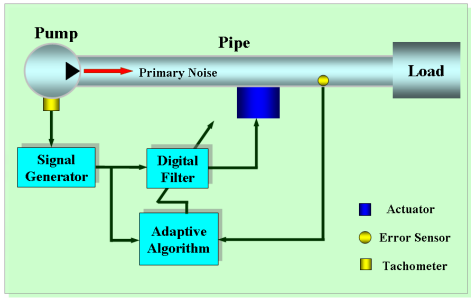
The project aims to derive robust active control methods for cancelling FBN for the system functioning in a variety of operating conditions and being subjected to sudden inputs.



Active control methods for cancelling FBN

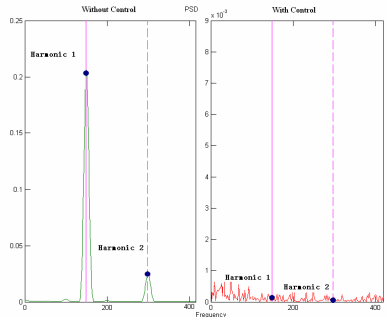
Based on Huygen's principle, an active control method for FBN was proposed by Kojima. This method deals with a real-time measurement of the progressive wave, which is used as an active attenuator of pressure ripple in fluid pipeline.

An adaptive least mean square (LMS) filter is an effective method for cancelling the FBN in a pipe. This algorithm is a feedforward control method that detects noise through the unknown plant and generates an anti-noise control signal to cancel the original noise. Wang successfully applied this method to attenuate periodic noise produced by pumps and motors at the PTMC.



Modelling and simulation

To help investigate the performance of the control system, a detailed simulation model of the hydraulic and adaptive control systemshas been constructed. The Method of Characteristics (MOC) is implemented to model time-varying flow and pressure in fluid pipelines and the LMS algorithm is used to cancel FBN in the control system.



Future work

Other methods of improving system performance will be developed. Factors affecting the stability and robustness of the system are to be investigated. The experiment will be implemented to verify results from theoretical analysis and simulations.

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