

Davide was born in 1984 in Parma (Italy). He received his B.Sc. and M.Sc. in Mechanical Engineering from University of Parma (Italy) in 2006 and 2009 respectively.

He is currently a Ph.D. candidate working at the Maha Fluid Power Research Center (Purdue University), under the supervision of Dr. Andrea Vacca.

The goal of his research is the formulation of control methods to improve the dynamics of mobile hydraulic machines (to increase productivity and energy efficiency).

Two reference cases were studied: hydraulic crane (NSF CCEFP grant); wheel loader (industrial research grant). In both cases, the study includes numerical modeling and experimental validation.

Davide presented the outcome of his research in several international conferences and poster sessions. Additionally, two papers are already published on international journals.



Dissertation Defense

Speaker:	Davide Cristofori
Title:	Advanced Control Strategies for Mobile Hydraulics Applications
Major Professor(s):	Dr. Andrea Vacca
Date:	Friday, November 22 nd , 2013
Time:	9:00 a.m.
Location:	Maha Fluid Power Research Center,
	1500 Kepner Dr., Lafayette (IN), 47905

Abstract:

Vibrations of the structure and load of mobile hydraulic machines are responsible for productivity reduction, and in extreme cases they harm operator's safety. Although state of the art vibration damping techniques are capable to reduce those drawbacks, they are often responsible for energy dissipation, system slow down, and increased complexity of the hydraulic circuit. Margin for improvement is provided by modern electro-hydraulic components and programmable controllers.

The goal of this research is the investigation of an active vibration damping method suitable for a general mobile hydraulic machine, not requiring for the modification of standard valve controlled electrohydraulic system.

The proposed controller is based on feedback signals provided by pressure sensors located in a well-protected area of the machine (directional valve workports). The proposed method is also compared with alternatives based on the use of accelerometers on the vibrating bodies of the machine (favorable condition from the control perspective, but often not as reliable as feedback from pressure sensors).

Two case studies are taken as reference: hydraulic crane (instrumented at Maha Lab); wheel loader (instrumented at industrial sponsor facility). In both cases a numerical model was developed and experiments served for validation and evaluation of the controller performance. Results confirm the effectiveness of the vibration damping method and its energy efficiency.

Application:

The general applicability of the proposed active vibration damping method to different mobile hydraulic machines was proven by the results obtained in the two different case studies (hydraulic crane and wheel loader). The research therefore can impact all mobile hydraulics applications by improving productivity, safety, and energy efficiency.