

2014 IFPE Technical Conference

**Where all the Solutions
Come Together and
Connections are Made**

**Las Vegas, Nevada, USA
5-7 March 2014**

ISBN: 978-1-63439-153-5

Printed from e-media with permission by:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571



Some format issues inherent in the e-media version may also appear in this print version.

Copyright© (2014) by the National Fluid Power Association (NFPA)
All rights reserved.

Printed by Curran Associates, Inc. (2014)

For permission requests, please contact the National Fluid Power Association (NFPA)
at the address below.

National Fluid Power Association (NFPA)
6737 W. Washington Street, Suite 2350
Milwaukee, Wisconsin, 53214

Phone: (414) 778-3344
Fax: (414) 778-3361

nfpa@nfpa.com

Additional copies of this publication are available from:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: 845-758-0400
Fax: 845-758-2634
Email: curran@proceedings.com
Web: www.proceedings.com

Table of Contents

Wednesday, March 5, 2014

8:45-9:15 am

1.1:

PCB System Dynamic Stability Utilizing Digital Prototyping 1

Michel Beyer, Senior Technical Specialist, Eaton

Tejas Shinde, Senior Engineer, Eaton

Suhas Dhakate, Lead Engineer, Eaton

9:15-9:45 am

1.2:

Innovative Hybrid Modeling Approach to Enhance Green Design based on Fully Integrated Mechatronic System Simulation 9

Vincent Remillard, Application Engineer/Technical Manager, Famic Technologies Inc.

Joe Sfeir, Famic Technologies Inc.

9:45-10:15 am

1.3:

Using Simulation to Create Real Efficiency in Hydraulic Control Systems 22

Dave Ruxton, Application Engineer, HydraForce, Inc.

Nick Stabile, Design Engineer, HydraForce, Inc.

8:45-9:15 am

2.1:

High speed industrial Ethernet technology revolutionizes off-highway vehicle automation architectures 31

Sari Germanos, Technology Marketing Manager, Ethernet POWERLINK Standardization Group

9:15-9:45 am

2.2:

Global Navigation Satellite Systems (GNSS) technologies for Off-Highway Agricultural Vehicles: The Benefits of Using State-of-Art Mobile Hydraulics Technology 34

Leroy Garciano, Systems and Applications Engineer, Danfoss Power Solutions (US) Company

Ricky Anderson, Sales Development Manager, Danfoss Power Solutions (US) Company

Jan Henrik Reese, Sales Development Manager, Danfoss Power Solutions ApS Denmark

9:45-10:15 am

2.3:

Machine Control with Only Two Hoses 37

Douglas Anderson, Systems and Application Engineer, Danfoss Power Solutions (US) Company

Michael Stoltenow, International Account Manager, Comatrol

8:45-9:15 am

3.1: **Custom Feedback Solves Tough Motion Control Problems**) \$

Peter Nachtwey, President, Delta Computer Systems Inc.

9:15-9:45 am

3.2:

Practical Solutions for Open Circuit System Instability))

Chad Daniel, Manager, BU Sales Americas; High Power Closed Circuit, Danfoss (US) Company

9:45-10:15 am

3.3:

Hydraulic Steering Jerk on Articulated Vehicles) * *

Jared Cave, Systems and Applications Engineer, Danfoss Power Solutions (US) Company

10:30-11:00 am

4.1:

Comparison of Steady State Flow Loss Models for Axial Piston Pumps) + %

Samuel Hall, System and Application Engineer, Danfoss Power Solutions (US) Company

Brian Steward, Professor, Iowa State University

11:00-11:30 am

4.2:

On the Hydraulic Pumps Modeling for Application Engineers, Article #1) + ,

Medhat Khalil, Director of Professional Education, MSOE

11:30 am-12:00 pm

4.3:

Mathematical Modeling and Experimental Research on Influence of Improved Stator Curve on the Characteristic of Vane Pump) - ,

Radovan Petrovic, Professor, College of Applied Engineering, Center for Power Control Hydraulics (CPCH)

Miroslav Zivkovic, Faculty of Engineering, University of Kragujevac

Nenad Todric, Faculty of Mechanical and Civil Engineering Kraljevo, University of Kragujevac

10:30-11:00 am

5.1:

Prediction of the Acoustic Radiation from a Hydraulic Piston Pump using Flexible Multibody Dynamics) % \$'

Michel Beyer, Senior Technical Specialist, Eaton

T.R. Milind, Senior Engineer, Eaton

11:00-11:30 am

5.2:

Optimization of Dissimilarly-Sized Dual In-line Suppressors) % % \$

Elliott Gruber, Graduate Student, Georgia Institute of Technology

Kenneth Cunefare, Professor, Georgia Institute of Technology

10:30-11:00 am

6.1:

Experimental Studies of Viscous Loss in a Hydraulic Flywheel Accumulator) % & %

Kyle Strohmaier, Master's Student, University of Minnesota-Twin Cities

Paul M. Cronk, University of Minnesota-Twin Cities
Anthony L. Knutson, University of Minnesota-Twin Cities
James D. Van de Ven, Ph.D., University of Minnesota-Twin Cities

11:00-11:30 am

6.2: **Fluid Power in Transportation** (

Charles Juhasz, Director of Engineering, Scientific Services Inc

2:15-2:45 pm

7.1: **Midsize Wind Turbines with Hydraulic Transmissions** ,

Feng Wang, PhD, Center for Compact and Efficient Fluid Power, Department of Mechanical Engineering, University of Minnesota

Kim A. Stelson, Center for Compact and Efficient Fluid Power, Department of Mechanical Engineering, University of Minnesota

2:45-3:15 pm

7.2: **Applications for Discrete Flow Pumps** ()

Matt Kronlage, Product Applications Engineer, Turolla (Member of the Danfoss Group)

3:15-3:45 pm

7.3: **DHTM475: The Evolution of Flow** \$

Elton Bishop, Manager, DigitalHydraulic LLC

2:15-2:45 pm

8.1: **Engine Overspeed Protection for Tier 4 Machines with Hydrostatic Transmissions** *

Simon Nielsen, Systems Engineer, Danfoss Power Solutions (US) Company

Frank Rozycki, Systems Engineer, Danfoss Power Solutions (US) Company

2:45-3:15 pm

8.2: **Modern Hydrostatic Propel Drives Change Wheeled Off-Road Vehicles** * '

Jörn Petersen, Sales Director Construction Machinery Sector, Bosch Rexroth

Roland Friedl, Sr. Application Engineer, Bosch Rexroth AG

Steve Bernardy, Sr. Applications Engineer, Bosch Rexroth Corporation

2:15-2:45 pm

9.1: **Hydraulic Generator Drive Robust Control** + \$

Christian Daley, Engineer, Danfoss Power Solutions (US) Company

2:45-3:15 pm

9.2: **A Novel Methodology of Displacement Calculation for the Swash Plate Axial Piston Pump with Angle Cylinder Block** + (

Will Guo, Engineering Team Leader, Danfoss Power Solutions (Zhejiang) Co., Ltd.

3:15-3:45 pm

9.3: **Design of a Variable Displacement Triplex Pump**
Shawn Wilhelm, PhD Candidate, University of Minnesota
James D. Van de Ven, Ph.D., University of Minnesota

4:00-4:30 pm
11.1: **Establishing an Optimal Work Cycle for an Alternative Wheel Loader Concept**
Bobbie Frank, Alternative Drivetrain Research Engineer, Volvo Construction Equipment and Lund University
Anders Fröberg, Volvo Construction Equipment

4:30-5:00 pm
11.2: **Real World Drive Cycle Construction Procedure for Off-Highway Vehicles**
QingHui Yuan, Manager, Eaton Corporation
Ojas Patil, Eaton Hydraulics Group
Aaron Jagoda, Eaton Hydraulics Group

4:00-4:30 pm
12.1: **Using System FMEAs to Improve Safety, Quality and Performance in Off-Highway Hydraulic Systems**
D. Dean Houdeshell, Manager, Systems & Application Engineering - Americas, Danfoss Power Solutions (US) Company

Thursday, March 6, 2014

8:45-9:15 am
13.1: **Study of Temperature and Lubricant Effects on the Efficiency of a Complete Hydrostatic Drive System**
Shubhamita Basu, Technology Manager, The Lubrizol Corporation
Edward Akucewich, Technical Fellow, The Lubrizol Corporation
Allison Rajakumar, The Lubrizol Corporation

9:15-9:45 am
13.2: **Effect of Base Stock Type on Film Thickness and Performance in Hydraulic Pumps**
Edward Akucewich, Technical Fellow, The Lubrizol Corporation
Betsy Butke, The Lubrizol Corporation
Thelma Marougy, Eaton

9:45-10:15 am
13.3: **Hydraulic Fluid Efficiency Effects in External Gear Pumps**
Paul Michael, Research Chemist, Milwaukee School of Engineering
Jill Bramer, Chemist, US Army TARDEC
Adam Puzzuoli, Mechanical Engineer, US Army TARDEC
Thomas Wanke, Director, Fluid Power Institute, Milwaukee School of Engineering

8:45-9:15 am

14.1:

A Numerical Model for the Simulation of Flow in Radial Piston Machines

Pulkit Agarwal, Graduate Student, Maha Fluid Power Research Center, Purdue University

Andrea Vacca, MAHA Fluid Power Research Center

Kwang SunKim, Daejin Hydraulic Machinery Inc

Taegual Kim, Daejin Hydraulic Machinery Inc

9:15-9:45 am

14.2:

New Non-Linear Model for a 4-Way Directional Control Servo or Proportional Valve

Jack Johnson, Electrohydraulic Engineer, IDAS Engineering Inc

9:45-10:15 am

14.3:

Application of a Non-Linear Model to a Highly Overlapped Electrohydraulic Proportional Valve

Jack Johnson, Electrohydraulic Engineer, IDAS Engineering Inc

9:15-9:45 am

15.2:

Applying Wireless Technology to Electro-Hydraulics: Architecture, Approval, and Safety Considerations

Anthony M. Di Tommaso, Manager, Product Development, Cervis Inc.

10:30-11:00 am

16.1:

Control and Stability Analysis of Practical Load-Sense Systems

Abhijit Das, Advanced Systems Engineer, Danfoss Power Solution (US) Company

Eric Bretey, Danfoss Power Solution (US) Company

11:00-11:30 am

16.2:

Methods to Adjust the Characteristic Curves of Electro-Hydraulic Proportional Valves in Mobile Applications

Jens Krallmann, Business Unit Manager, Thomas Magnete GmbH

Mark Jankowski, Engineering Manager, Thomas Magnete USA

Michael Lutz, Sales Manager, Thomas Magnete GmbH

11:30 am-12:00 pm

16.3:

Empirical Method Produces Improved Consistency In Variable Discharge Coefficient Effects

Jack Johnson, Electrohydraulic Engineer, IDAS Engineering Inc

10:30-11:00 am

17.1:

Environmentally Acceptable Lubricants in the Fluid Power Industry

Mark Miller, Executive Vice President, RSC Biosolutions/Terresolve Technologies

11:00-11:30 am

17.2:

Improving Fuel Efficiency, Productivity and GHG Emissions of Off-Highway Equipment Through the Use of Energy Efficient Hydraulic

Fluids &+

Thomas Schimmel, Business Segment Manager, Hydraulic Fluids, Evonik Oil Additives USA, Inc.

M. Alibert, Evonik Industries AG

F. O. Maehling, Evonik Industries AG

T. Bartels, Evonik Industries AG

10:30-11:00 am

18.1:

Energy Efficient Impulse/Fatigue Testing (

Timothy Kerrigan, Fluid Power Consulting Engineer, MSOE - Fluid Power Institute

Jon Shibiliski, Milwaukee School of Engineering Fluid Power Institute

Russ Steinmetz, Milwaukee School of Engineering Fluid Power Institute

11:00-11:30 am

18.2:

Pressure Ripple Energy Harvester Enabling Autonomous Sensing -

Ellen Skow, Research Graduate Assistant, Georgia Institute of Technology

Zachary Koontz, Undergraduate Researcher, Georgia Institute of Technology

Chong Woo Han, Undergraduate Researcher, Center for Compact and Efficient Fluid Power REU

Kenneth Cunefare, Professor, Georgia Institute of Technology

Alper Erturk, Assistant Professor, Georgia Institute of Technology

2:15-2:45 pm

19.1:

Control Systems Development for a Hydraulic Hybrid Lift Truck ((

Michael Olson, Lead Engineer - Controls and Modeling, Eaton Corporation

Tim Meehan, Eaton

2:45-3:15 pm

19.2:

Hydraulic Hybrid System for Swing Energy Recovery and Reuse)'

Jiao Zhang, Engineering Technical Steward, Caterpillar, Inc.

2:15-2:45 pm

20.1:

Got Water? * \$

Jawad Khan, Sr. Data Analyst, POLARIS Laboratories

2:45-3:15 pm

20.2:

Laboratory and Field Investigations of Water-Adsorbing Oil Filters and Relative Humidity Sensors * *

Paul Michael, Research Chemist, Milwaukee School of Engineering

Alexandria Dyszelski, Research Assistant, Milwaukee School of Engineering

Tim Kerrigan, Project Engineer, Milwaukee School of Engineering

Meghan Krause, Research Assistant, Milwaukee School of Engineering

3:15-3:45 pm

20.3:

Impact of the Use of Secondary Particle Counter Calibration Samples on Particle Count and Filter Test Results +&

Bryan Steffen, CV Test Engineer, Cummins Filtration Inc.
Barry Verdegan, Cummins Filtration Inc.

2:15-2:45 pm
21.1:

Reversing Hydraulic Fan Drives ++

Stephen Frantz, Staff Engineer, Danfoss Power Solutions (US) Company

2:45-3:15 pm
21.2:

Dedicated Closed Circuit Hydrostatic Fan Drive Control , (

Josh Cronbaugh, Product Engineer, Danfoss Power Solutions (US) Company
Mark Peterson, Staff Engineer, Danfoss Power Solutions (US) Company

3:15-3:45 pm
21.3:

Open Circuit Fan System Stability Analysis - \$

Robert Harris, Systems and Application Engineer, Danfoss Power Solutions (US) Company

4:00-4:30 pm
22.1:

Meeting ISO3744 - Determination of Airborne Noise Generated by Hydrostatic Unit - *

Jaromir Tvaruzek, Engineering Manager, Danfoss Power Solutions (US) Company
Dariusz Szymanski, Test lab Engineer, Danfoss Power Solutions (US) Company

4:30-5:00 pm
22.2:

Development of Portable Pneumatic Educational Tool for STEM Education (\$\$

Farid Breidi, Student, Purdue University
Tyler Helmus, Student, Purdue University
John Lumkes, Associate Professor, Purdue University

4:00-4:30 pm
24.1:

Novel Use of a U-style Hydrostatic Transmission to Develop a Low-Power Dual-Mode Transmission (\$,

Wyatt Hall, Engineering Intern, Danfoss Power Solutions (US) Company

4:30-5:00 pm
24.2:

Low Power Source Hydrostatic Transmission (%

David Johnson, Student/Applications Engineer, Milwaukee School of Engineering/Hengli America Corporation

Friday, March 7, 2014

9:15-9:45 am
25.1:

New Process for Improved Seamless Forged Pipes for Hydraulic Cylinders (&%

Pierre Sutter, Product Manager, Vallourec
Rodolfo Nirello, Vallourec

9:15-9:45 am

25.2:

Pressure Ratings and Design Guidelines for Continuous Cast Ductile Iron in Hydraulic Applications (&

Bob O'Rourke, Product Engineering Manager, Dura-Bar
Gordon Weiler, National Sales Manager, Daman Products Company

8:45-9:15 am

26.1:

Characteristics of Air Flow Control Components for the Emergency Breathing System (' *

So-Nam Yun, Valve Developer, Korea Institute of Machinery & Materials
Young-Bog Ham, Korea Institute of Machinery and Materials
Jung-Ho Park, Korea Institute of Machinery and Materials
Hyun-Se Kim, Korea Institute of Machinery and Materials

9:15-9:45 am

26.2:

Heat and Efficiency Considerations in Fluid-Powered Co-Robotics Applications ((&

Douglas Cook, Staff Researcher, Milwaukee School of Engineering

9:45-10:15 am

26.3:

Walking Energy Hydraulic Regeneration Potential to Extend Range of Active Orthotic Exoskeletons ((+

Keith Fisher, Associate Professor, Montana State University

8:45-9:15 am

27.1:

Air Bubble Separation and Elimination from Working Fluids for Performance Improvement of Hydraulic Systems (() '

Yutaka Tanaka, Professor, Hosei University
Sayako Sakama, Ph. D. student, Hosei University
Haruna Higashi, Student, Hosei University
Hiroyuki Goto, Manager, Technical Research Institute, JSPM
Ryushi Suzuki, President, Opus System Inc.

9:15-9:45 am

27.2:

Investigation of the Impact of Oil Aeration on Outlet Flow Oscillations in External Gear Pumps ((* %

Andrea Vacca, Assistant Professor, Maha Fluid Power Research Center, Purdue University
Junje Zhou, Beijing Institute of Technology University
Paolo Casoli, Industrial Engineering Department, University of Parma, Italy
Antonio Lettini, Casappa SpA, Lemignano di Collecchio, Parma, Italy

10:30-11:00 am

28.1:

Mobile Equipment Reservoir Baffle Innovation ((+ %

Robert Post, Contributing IFPS Member, on behalf of IFPS

11:00-11:30 am

28.2:

Charge Pump and Loop Flush Sizing for Closed Loop, One Pump,

Multi-Motor Systems (++)

Brent Sinclair, Systems and Applications Engineer, Danfoss Power Solutions (US) Company

10:30-11:00 am

29.1:

Modeling, Simulation and Analysis of a Simple Load Sense System (, ')

Leroy O. Garciano, Systems and Applications Engineer, Danfoss Power Solutions (US) Company

Latinus E. Boylston, Jr., Systems and Applications Engineer, Danfoss Power Solutions (US) Company

Stephen D. Cromer, Senior Account Manager, Danfoss Power Solutions (US) Company

11:00-11:30 am

29.2:

Improving the Position Control Performance of a Proportional Spool Valve, Using 3D CFD Modeling (, -)

Emma Frosina, PhD Student, University of Naples Federico II

Adolfo Senatore, Professor, University of Naples Federico II

Dario Buono, Researcher, University of Naples Federico II

Michele Pavanetto, Engineer, Diplomatic Oleodinamica S.p.A.

Ina Costin, Engineer, Diplomatic Oleodinamica S.p.A.

Micaela Olivetti, Engineer, OMIQ s.r.l.

10:30-11:00 am

30.1:

Experimental Characterization of External Gear Machines with Asymmetric Teeth Profile (') \$\$

Ram Sudarsan Devendran, PhD Student, Maha Fluid Power Research Center, Purdue University

Andrea Vacca, MAHA Fluid Power Research Center
