Maha Fluid Power Research Center

Fundamentals in Industrial and Mobile Hydraulics

Register

Registration Link: https://cvent.me/048Meq

Contact Information

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Dates: Summer session

July 10th – July 14th. Monday – Thursday whole days and Friday morning

Target Audience and preferred experience:

This course is designed for industry professionals who have:

- Engineering degrees or equivalent.
- Interest in increasing their fundamental understanding of hydraulic equipment for mobile or industrial applications.
- Beginner level in fluid power (0-3 years of experience)
- Interest in broad concepts in fluid power

Course Description:

This course provides an introduction into modeling and design of hydraulic components and systems. This course focuses on modeling techniques based on physical laws and measured performance characteristics. These techniques will be applied to the design and analysis of component and systems used in hydraulic applications in mobile equipment. The course will begin with fundamental aspects of fluid flow, standardized symbols, common hydraulic circuits and typical functioning principles for the moving parts inside of the components. The course is paired with hands on laboratory exercises focused on reinforcing the concepts learned in the class with the use of computer simulations as well as tear down of components and real life circuits on hydraulic trainers.

Topics and schedule:

Day 1: Lab 1:	- Fluid properties and fundamental laws of hydrostatics and pneumatics o Fluids: function and properties, density, specific gravity o Fluid properties, Bulk modulus, Viscosity and viscosity index o Pascal's law in hydraulic systems. Energy and power, force, flow, velocity, pressure. o Conservation of energy, continuity equation. Hydraulic power. - Symbology and standardization - Cavitation and Filtration **Hydraulic and pneumatic simulation of simple circuits using FluidSim and Matlab-Simscape (Steady state analysis only) Computer lab**
Day 2: Lab 2:	- Pressure, flow and power loss in fluid power systems o Frictional losses in laminar and turbulent flow - Component physical principles and applications I (General) o Pumps (Gear, Piston, vane) o Motors o Linear actuators o Hydrostatic transmission (General principles and drivetrain configurations) **Hydrostatic transmission teardown hands on Lab (2 hours and computer simulation (1.5 hours)**
Day 3: Lab 3:	- Component principles and applications II (valves and ancillary components) - Valve simulation and application in hydraulic systems o Pressure control valves, o Flow control valves, o Directional control valves o Reservoirs o Heat exchangers o Accumulators **Pilot operated Relief valve tear down in the lab (1.5 hours), simulation and theoretical analysis for sequence circuits (2 hours) Computer simulation.**
Day 4: Lab 4:	- Commonly used fluid power circuits o Mobile applications ▪ Priority valve applications ▪ Counterbalance valve applications ▪ Series, Parallel and Power split hybrids o Industrial applications ▪ Automatic circuits ▪ Electro-hydraulics, Basic PLC logic o Pneumatic applications ▪ Pneumatic logic systems, cascade and shift register systems **Various automatic circuit construction in the lab (2 hours) simulation using pressure control valves and other pilot operated devices (1.5 hours)**

Day 5:	- Full system simulation fundamentals and dynamic control systems for fluid power engineering - Practical Block diagrams and Laplace Transform - Lumped parameter modeling
Lab 5:	**Hydraulic control system simulation (1.5 hours) in the computer laboratory**

Learning Objectives:

1. Understand and reflect on the significance of fluid selection and or conditioning on a fluid power system.
2. Estimate and identify the sources of pressure, flow or power loss in a hydraulic system.
3. Recognize and analyze factors that affect the performance of a fluid power component in operation trough computer simulation.
4. Model via computer simulation the behavior of a system controlled by hydraulic valves.
5. Recognize and troubleshoot commonly used fluid power systems.
6. Assessing and predicting the dynamic performance of a system using computer-based simulations in FluidSim and Matlab Simscape.

No Textbook is required for the course (The list below is for your reference only):

- Vacca, Andrea., Franzoni, Germano. Hydraulic Fluid Power: Fundamentals, Applications, and Circuit Design. United Kingdom: Wiley, 2021.
- Manring, Noah D., and Roger C. Fales. Hydraulic control systems. John Wiley & Sons, 2019.
- El-Din, Mahmoud Galal, and Mohamed Rabi. Fluid power engineering. McGraw-Hill Education, 2009.

Attendance:
The minicourse will open to in-person participants at Purdue University: max 20 participants

Cost:

Free registration for:
- 1 participant from Maha Fluid Power Research Center Basic Members
- 2 participants from new Maha Fluid Power Research Center Basic Members (joining the center in 2023)
- 3 participants from Maha Fluid Power Research Center Executive Members

$ 1,500 / additional participants from members (*)
$3,500 / participant for non-members (*)
(*) registration priority goes to members benefitting from free registration as detailed above

Registration includes all course material (books not included), lunches, and coffee breaks. No dinner/hotel accommodation provided.