COLLABORATING LABORATORIES

Ray W. Herrick Laboratories
140 S. Martin Jischke Dr.
West Lafayette, IN 47907-2031

MAHA Fluid Power Research Center,
and Purdue Center for Systems Integrity
1500 Keper Drive
Lafayette, IN 47905

Catalysis Laboratory
Forney Hall of Chemical Engineering
480 Stadium Mall Drive
West Lafayette, IN 47907-2100

Energy Conversion Research and
Energy Systems Simulation Laboratories
Electrical Engineering Building
465 Northwestern Avenue
West Lafayette, Indiana 47907-2035

Mechanical Engineering Tribology Laboratory
555 Purdue Mall
West Lafayette, IN 47907-2088

PEOPLE

Peter Meckl (ME)  
Engine and aftertreatment diagnostics

Ray Decarlo (ECE)  
Power Management and control in hybrid vehicles

Farshid Sadeghi (ME)  
Lube lab on a chip, tribology in transmission systems

Fabio Ribeiro (ChemE)  
Catalyst kinetics

Research to make clean, efficient, fuel-flexible ground-vehicle powertrains

https://engineering.purdue.edu/Engr

Purdue is an equal access/equal opportunity university

DRAMATICALLY REDUCE:

Dependence on foreign oil
Oil consumption, and pollutants causing:
global-warming (CO$_2$), smog (NO$_x$), and respiratory tract damage (soot)

Provide consumers with flexible fuel options and lower vehicle-use costs

Dramaticall y /Reduction of Dependence on foreign oil
Oil consumption, and pollutants causing:
global-warming (CO$_2$), smog (NO$_x$), and respiratory tract damage (soot)

Provide consumers with flexible fuel options and lower vehicle-use costs

https://engineering.purdue.edu/Engr
Regeneration control algorithms for diesel particulate filters using high-bandwidth pressure sensing.

Crack detection in diesel particulate filters using spectral signal processing techniques.

Chemical and transport models for NOx traps including the investigation of detailed kinetic and chemical transformation mechanisms.

Experimental determination of kinetic parameters for processes occurring during NOx trapping.

Determination of benchmark parameter models of aftertreatment devices.

The focus is on new transmission concepts including advanced power train control strategies for off-road and on-road vehicles. The goal of the research is to investigate ways to drastically reduce fuel consumption and emissions for different kinds of vehicles. The research activities include:

- Modeling and simulating of power trains using PSDD, an in-house MATLAB/Simulink library.
- Performance prediction, including fuel consumption.
- New circuit solutions for continuously variable transmissions and hydraulic hybrids.
- Advanced power train controls.
- Hardware-in-the-loop testing of powertrains.
- Energy recovery.

Acoustic modeling and noise control for vehicle powertrains.

Crack detection in diesel particulate filters.

Development of On-Board Diagnostic (OBD) algorithms to detect and isolate emissions faults.

Acoustic modeling and noise control for vehicle powertrains.

Multi-objective design of electric machinery.

Modeling and analysis of power electronic systems.

Distributed heterogeneous computing.

Minimization of acoustic noise and vibration from electric machinery.

Prognostics and health management of electric drives.

Electronically controlled continuously variable transmission (CVT) design.

Powertrain control strategies for economy, emissions, and performance.

Flywheel design and energy storage.

Modeling of and control of power flow in hybrid systems and hybrid electric vehicles.

Crack detection in diesel particulate filters.

Acoustic modeling and noise control for vehicle powertrains.

Modeling of sound sources and sound transmission.

Experimental techniques for power train noise evaluation and model development.

Pass-by noise diagnostics and visualization.

Design of noise control materials, acoustic barriers and enclosures.

Sound quality and environmental noise impact modeling.

Evaluation of friction material for braking performance and reduction of friction-induced vibrations/noise in braking systems.

Modeling and prediction for reliability in powertrain drivelines, transmissions, and wheel ends:

- Rotordynamic modeling of drivelines and wheels for hybrid vehicle development and torsional analysis.
- Fault diagnostics in powertrains to support durability testing and fault-tolerant control strategies.
- Prognosis of powertrain performance to enable durability predictions and life-extending control.
- Development of On-Board Diagnostic (OBD) algorithms to detect and isolate emissions faults.

Hardware-in-the-loop testing of powertrains.

Modeling and analysis of power electronic systems.

Minimization of acoustic noise and vibration from electric machinery.

Ray W Herrick Laboratory:
- Fully flexible variable valve actuation (VVA) system for camless engine research.
- Rolling chassis dynamometer and tire pavement test apparatus for driveline and wheel-efficiency testing.
- Large semi-anechoic chamber with engine test stand.
- Microphone arrays for sound field visualization and sound power measurements.

MAHSA Fluid Power Laboratory:
- Hardware-in-the-loop testing of vehicle powertrain.
- Transmission and multiple pump and motor test rigs.
- 550 kW hydraulic power supply, 12,000 square foot lab area.