



WISCONSIN
UNIVERSITY OF WISCONSIN-MADISON

Department of Engineering
Professional Development

The University of Wisconsin–Madison offers courses at your location focusing on engine air handling and turbocharging. Curriculum for course topics is designed by UW–Madison faculty and industry experts, and in cooperation with the Engine Research Center (ERC). The University’s ERC has a long and distinguished record of research and education pertaining to internal combustion engines and advanced propulsion systems.

Our staff will work with you to tailor our programs to meet your development goals.

Engine Air Handling and Turbocharging		
Topic <i>(Each session is approximately 1 hour 10 minutes)</i>	Three-day course	Two-day course
Course Introduction	X	X
Air Handling System Overview <ul style="list-style-type: none"> ▪ System objectives ▪ System configurations ▪ Relevant calculations and terminology 	X	
Valve Event Timing <ul style="list-style-type: none"> ▪ Determining optimum event timings ▪ Load control through valve events ▪ Compression control and the Miller cycle 	X	X
Variable Valve Actuation Systems <ul style="list-style-type: none"> ▪ Volumetric efficiency versus engine speed ▪ Further attractions of variable valve actuation systems ▪ “Camless” engines 	X	
Flow Requirements and Characterization <ul style="list-style-type: none"> ▪ Bulk flow parameters—measurement and importance in the combustion system ▪ Flow bench measurement and uses ▪ Swirl and tumble measurement 	X	X
Advanced Air Flow Measurements <ul style="list-style-type: none"> ▪ Flow field measurement techniques ▪ Laser techniques ▪ Practical use of detailed measurements in engine development 	X	Reduced
Computational Tools in Air Handling System Development <ul style="list-style-type: none"> ▪ Engine cycle simulation ▪ Intake and exhaust flow dynamics ▪ Capabilities and limitations of CFD 	X	Reduced
Introduction to Turbocharging <ul style="list-style-type: none"> ▪ Turbocharger design and construction ▪ Charge air cooling ▪ First look at system configuration 	X	X
Turbocharger Performance and Maps <ul style="list-style-type: none"> ▪ Thermodynamic look at compressor and turbine processes ▪ Compressor maps and limits ▪ Turbine maps 	X	
Matching the Turbocharger to Engine Performance Requirements <ul style="list-style-type: none"> ▪ Breathing lines ▪ Compressor map selection ▪ The use of wastegates and variable geometry 	X	X
Two-Stage Systems and Matching <ul style="list-style-type: none"> ▪ Series, parallel, and sequential systems ▪ Engine matching in two-stage systems ▪ Further considerations in cooling and control 	X	X



Engine Air Handling and Turbocharging *continued*

Topic (Each session is approximately 1 hour 10 minutes)	Three-day course	Two-day course
Addressing the Challenges of Downsizing and Boosting <ul style="list-style-type: none"> ▪ Torque curve requirements ▪ Further challenges and approaches ▪ Example systems 	X	X
Addressing the Challenges of Exhaust Gas Recirculation (EGR) <ul style="list-style-type: none"> ▪ Identifying system requirements and approaches ▪ EGR maps in light- and heavy-duty applications ▪ Combustion system trends 	X	X
Additional Sections		
Supercharging Approaches and Hardware <ul style="list-style-type: none"> ▪ General construction ▪ Roots versus Lysholm and screw ▪ Configurations 	X	
Supercharger Sizing and Thermodynamics <ul style="list-style-type: none"> ▪ Thermodynamics of the compression process ▪ Compressor performance maps ▪ Engine matching 	X	
Supercharger Application <ul style="list-style-type: none"> ▪ Throttle placement ▪ Bypass and clutch systems ▪ Example applications 	X	

For more information about courses available at your site, including optimal group size and costs, contact:

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