

Simulation Software Training Courses



SOLUTIONS FOR VIRTUAL TEST DRIVING



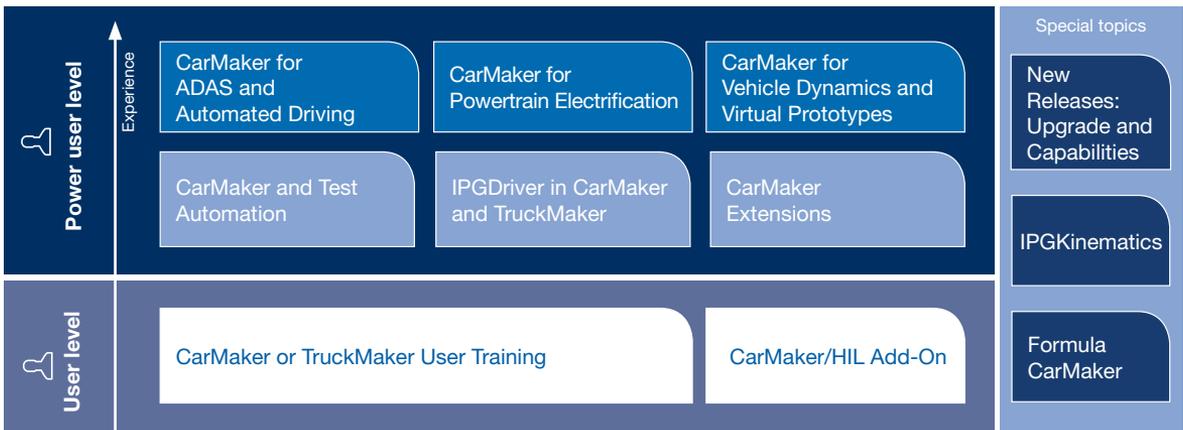
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Virtual testing made easy:

Learn how to effectively use the simulation solutions of the CarMaker product family

IPG Automotive offers training courses for various levels and target audiences to ready our customers for the efficient work with our simulation solutions. Both new users and power users have the opportunity to gain profound insights into the specific aspects and applications of our simulation software. The courses are tailored to different levels of knowledge and various target participants. Varied contents cover basic information on the use of the CarMaker product family, transfer of knowledge as well as the versatile possibilities of using and adapting the solutions to the users' specific needs.

The courses are offered on a regular basis, once every quarter in Karlsruhe. In addition, customers have the opportunity to attend training courses at our offices in Germany as well as at our various international offices. We also offer on-site training courses at our customers' national or international locations that can be tailored to their respective needs.



The following overview lists the topics and user levels of the individual courses. Find detailed information on the individual training courses in this brochure or on our website at www.ipg-automotive.com.



CarMaker or TruckMaker User Training

This course is ideal for users who are new to working with the simulation solutions of the CarMaker product family (CarMaker, TruckMaker and MotorcycleMaker) or applying them in new contexts. We will provide a detailed overview of the functions of the simulation environment and guide you through the first steps. The basics taught in this course can be applied to the use of CarMaker as well as TruckMaker and MotorcycleMaker.

Requirements	None
Duration	2 days
Target audience	<p>Engineers in the fields of vehicle simulation, ECU development and validation, development of control algorithms and system integration for the following areas of application:</p> <ul style="list-style-type: none"> • Vehicle dynamics • Advanced driver assistance systems and automated driving • Powertrain simulation
Course outline	<ul style="list-style-type: none"> • Introduction to the simulation software CarMaker • Visualization with IPGMovie • Data analysis with IPGControl and post-processing • Scenario generation for virtual test driving • Introduction to the driver model IPGDriver • Introduction to vehicle model parameterization • Test automation basics with CarMaker • Controller development with CarMaker: CarMaker for Simulink • CarMaker as an integration platform: Getting acquainted with model integration options in CarMaker (FMU, Simulink Coder Interface, and more) • Other elements and properties of CarMaker
Goals	<ul style="list-style-type: none"> • Learning the basics of using CarMaker, TruckMaker and MotorcycleMaker • Understanding the main functions • Gaining experience in using the simulation software

CarMaker/HIL Add-On

This course complements the CarMaker User Training and covers hardware-in-the-loop specific content, in particular the additional components and specific features of CarMaker/HIL. The course comprises two modules: While the first module gives general information on HIL simulation and additional components in CarMaker, the second module focuses on specific issues in the use of different hardware architectures. Please specify in advance for which architecture you require training (Xpack4, dSPACE SCALEXIO or National Instruments PXI). As part of the training courses, IPG Automotive HIL systems or your own HIL systems can be used for demonstration purposes at your location.

Requirements	<ul style="list-style-type: none"> • Basics in C programming are preferable • Knowledge of CarMaker is an asset
Duration	1 day
Target audience	Engineers in the fields of ECU development and validation as well as hardware-in-the-loop simulation
Course outline	<ul style="list-style-type: none"> • Overview of CarMaker/HIL and real-time simulation • Introduction to the Xpack4 architecture • Use of CarMaker on a HIL test bench • I/O configuration of different bus systems and restbus simulation using the I/O Configurator • Generation of electrical faults using the Fail Safe Tester • ECU diagnosis
Goals	<ul style="list-style-type: none"> • Configuring real-time systems • Generating a restbus simulation using CarMaker • Running HIL simulations using CarMaker

CarMaker and Test Automation

This training course is ideal for users working with large numbers of test scenarios. We will show you how to run these in automated mode and how the possibilities of test automation in CarMaker enable the automated analysis and evaluation of the large amount of obtained data.

Requirements	Prior participation in a CarMaker User Training or, at a minimum, relevant experience with CarMaker
Duration	1 day
Target audience	<ul style="list-style-type: none"> • Simulation specialists looking to increase their productivity with an automated development environment • Engineers responsible for test planning and execution • HiL users with automation requirements who want to speed up the evaluation of large numbers of tests
Course outline	<ul style="list-style-type: none"> • Illustration of the test automation tools of the CarMaker product family • Script-based test automation with ScriptControl • Test automation with Test Manager and Test Configurator • Generation of characteristic values and evaluation criteria for the test report • CarMaker APIs for test automation and remote control of CarMaker • Tcl/tk basics
Goals	<ul style="list-style-type: none"> • Increasing efficiency and productivity in the simulation environment using test automation • Generating a wide selection of automated test scenarios using the different tools in CarMaker • Creating specific test reports with characteristic values and evaluation criteria to efficiently assess the simulation results • Compiling test catalogs in Test Configurator

IPGDriver in CarMaker and TruckMaker

The adaptive driver model IPGDriver is one of the central components for the generation of realistic virtual test scenarios with CarMaker in addition to the vehicle and road models as well as the environment and traffic models. Learn how best to use it in this course.

Requirements	Prior participation in a CarMaker User Training or, at a minimum, relevant experience with CarMaker
Duration	1 day
Target audience	Simulation specialists interested in optimally using the driver model IPGDriver
Course outline	<ul style="list-style-type: none">• Detailed insight into the driver model• Parameterization of the driver model• Adjustment of the driver parameterization for special driving maneuvers• Fine-tuning of the course and the speed• Race Driver
Goals	<ul style="list-style-type: none">• Expanding the possible uses of CarMaker by optimally adjusting IPGDriver• Making validation easier by optimizing the driver model

CarMaker Extensions

This course addresses the extension and adaptation of the CarMaker simulation environment: Learn how to integrate your own models of vehicle components and control systems and how to program your own signals.

Requirements	<ul style="list-style-type: none"> • Prior participation in a CarMaker User Training or, at a minimum, relevant experience with CarMaker • Basics in C programming are preferable
Duration	1 day
Target audience	<ul style="list-style-type: none"> • CarMaker users interested in applying model integration in CarMaker and its varied possibilities for the first time • Simulation engineers who would like to expand or replace existing models of CarMaker • Engineers in the system integration field looking to use different interfaces
Course outline	<ul style="list-style-type: none"> • Introduction to the structure of the CarMaker C code interface • Model Manager basics • Integration of C-programmed models of components and controllers in CarMaker • Expansion of the Data Dictionary with own quantities • Overview of compilers and debugging methods used • Integration of Simulink models using the Simulink Coder Interface Plug-In and use of “tunable parameters” • Integration of Functional Mock-up Units
Goals	<ul style="list-style-type: none"> • Using the CarMaker C code functions • Expanding the simulation with your own code • Integrating models with all CarMaker options: C code, Simulink Coder, FMI



CarMaker for ADAS and Automated Driving

This course focuses on the application of virtual test driving for the development of advanced driver assistance systems and automated driving functions. The essential product features are explained in detail.

Requirements	Prior participation in a CarMaker User Training or, at a minimum, relevant experience with CarMaker
Duration	2 days
Target audience	<p>Simulation engineers</p> <ul style="list-style-type: none"> • who work on the development of advanced driver assistance systems and automated driving functions • who are interested in the use of sensor models in simulation • who develop functions and need to run functionality tests
Course outline	<ul style="list-style-type: none"> • CarMaker functions for the simulation-based development of advanced driver assistance systems and automated driving functions • Ideal sensors in CarMaker: Object Sensor, Free Space Sensor, Free Space Sensor Plus, Traffic Sign Sensor, Line Sensor, Road Property Sensor, Collision Detection Sensor • Scenario Editor for the generation of ROAD5 road networks and environments • Import of road networks using the ADASRP plug-in • Use and configuration of IPGTraffic • High-fidelity sensor models: Radar Sensor, GNSS Sensor • Use of an electronic horizon in CarMaker • Raw Signal Interface sensors: Camera RSI, Radar RSI, Ultrasonic RSI • Integration of control algorithms for ADAS and AD
Goals	<ul style="list-style-type: none"> • Getting to know and using the ADAS and AD application-specific features of CarMaker • Generating complex ADAS and AD test cases • Using the different sensor model classes for environment recognition • Adjusting IPGDriver to test ADAS and AD functions



CarMaker for Powertrain Electrification

This course covers the use of the simulation software to develop and test powertrain components and systems in order to evaluate driving performance, consumption, emissions as well as durability under real driving conditions, and advance their optimization.

Requirements	Prior participation in a CarMaker User Training or, at a minimum, relevant experience with CarMaker
Duration	1 day
Target audience	Simulation engineers in the field of powertrain development <ul style="list-style-type: none">• who develop operating strategies for hybrid and electric vehicles• who design powertrain components• who want to conduct concept studies for new powertrains• who are responsible for function development in the powertrain field
Course outline	<ul style="list-style-type: none">• Overview of the structure of powertrain models and the respective component models in CarMaker• Parameterization of existing and integration of own component models• Generation of your own operating strategy for hybrid and electric vehicles• Interaction of advanced driver assistance systems with powertrain functions• Introduction to the generation of ROAD5 road networks
Goals	<ul style="list-style-type: none">• Getting to know and using the powertrain-specific features of CarMaker• Implementing operating strategies in the simulation environment CarMaker• Generating roads for powertrain development



CarMaker for Vehicle Dynamics and Virtual Prototypes

This course covers the use of the simulation software to develop and test chassis, vehicle systems as well as chassis control systems. The aim of this course is to parameterize and validate the vehicle model to enable vehicle handling optimization up to virtual ESC homologation.

Note: This course is also available as “TruckMaker for Vehicle Dynamics and Virtual Prototypes” which explicitly covers the vehicle model of TruckMaker and its heavy-duty vehicle-specific models.

Requirements	Prior participation in a CarMaker User Training or, at a minimum, relevant experience with CarMaker
Duration	1 day
Target audience	Simulation engineers in the field of vehicle development <ul style="list-style-type: none"> • who optimize the suspension and chassis • who develop and tune vehicle control systems • who are responsible for the (central) validation and supply of vehicle models • who analyze the influence of advanced driver assistance systems on full vehicle handling
Course outline	<ul style="list-style-type: none"> • Introduction to the use of virtual prototypes • Generation of test cases for vehicle dynamics applications: Generation of ROAD5 road models and the environment using the Scenario Editor and maneuver definition • Basics of IPGDriver functionalities that are specific to vehicle dynamics applications • Vehicle model in CarMaker and parameterization of a virtual prototype with a focus on suspension components and models including MBS axles and tires in CarMaker, and detailed coverage of brake, powertrain and trailer models • Virtual prototype validation methods
Goals	<ul style="list-style-type: none"> • Getting to know all relevant CarMaker product features • Generating (scenario-based) test cases for vehicle dynamics applications • Parameterizing and validating the vehicle model for your particular use case



New Releases: Upgrade and Capabilities

The CarMaker release training course focuses on the respective new product features of a CarMaker major release: What's new? What has changed? How can you benefit from these features in your development process? Throughout this course, you will learn about the new features in detail, enabling you to rapidly master the new possibilities and polish up your knowledge to continue working efficiently with our software.

Requirements	Relevant experience with CarMaker
Duration	1 day
Target audience	CarMaker users interested in a detailed overview and illustration of new features
Course outline	The topics covered are tailored to the respective CarMaker release. Courses are available from major release 6.0. Specific exercises help you apply your new knowledge.
Goals	Getting to know the new features of the respective CarMaker major release

IPGKinematics

This course focuses on the CarMaker add-on IPGKinematics and the use of the virtual K&C test bench for the development and optimization of suspensions. You can easily analyze the test results and smoothly transfer them to your CarMaker or TruckMaker development environment.

Requirements	None
Duration	1 day
Target audience	Simulation specialists in the field of vehicle dynamics
Course outline	<ul style="list-style-type: none"> • Introduction to IPGKinematics • Basics of existing models and templates for vehicle axles • Suspension parameterization and simulation • Result analysis and use in CarMaker • FAQs • Hands-on exercises to apply new knowledge
Goals	Efficiently using IPGKinematics in the vehicle development process with CarMaker

Formula CarMaker

This training course is specifically tailored to the application of the simulation solution CarMaker in the context of the Formula Student racing series.

Requirements	None
Duration	1 day
Target audience	Members (students) of a Formula CarMaker team
Course outline	<ul style="list-style-type: none"> • Overview of the CarMaker environment • Generation of a virtual TestTrack and scenario • Basics of vehicle model parameterization • Introduction to IPGKinematics • Data analysis with IPGControl and post-processing • Controller integration with CarMaker for Simulink
Goals	<ul style="list-style-type: none"> • Learning to use our simulation solutions for the Formula Student and Formula Student Electric racing series • Developing and optimizing the suspension with virtual test driving

About IPG Automotive

As a global leader in virtual test driving technology, IPG Automotive develops innovative simulation solutions for vehicle development. Designed for seamless use, the software and hardware products can be applied throughout the entire development process. IPG Automotive is an expert in the field of virtual development methods for the application areas of ADAS & Automated Driving, Powertrain, and Vehicle Dynamics. Together with its international clients and partners, the company is pioneering simulation technology that is increasing the efficiency of development processes.



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