MotionDesk

Sensor Simulation Control

For MotionDesk 4.8 and Sensor Simulation 1.5

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dSPACE

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About This Document

Contents

This document introduces you to the configuration and control of the SensorSim application and the creation of a MotionDesk scene with sensors to produce the data for Sensor Simulation.

Target group

Engineers that want to control the SensorSim application and configure sensors in a MotionDesk scene for the sensor simulation must read this document.

Required knowledge

To work with sensor simulation, basic knowledge in handling the dSPACE software, ASM Vehicle Simulations, ModelDesk, and MotionDesk scene creation and animation is assumed.

Knowledge of hardware-in-the-loop (HIL) real-time simulation using a SCALEXIO platform and software-in-the-loop (SIL) offline simulation using VEOS is advised. This includes implementing models in MATLAB/Simulink and ConfigurationDesk.

Familiarity with the types of sensors used in ADAS/AD systems is also advised to work with sensor simulation.

Symbols

dSPACE user documentation uses the following symbols:

Symbol	Description
DANGER	Indicates a hazardous situation that, if not avoided, will result in death or serious injury.
WARNING	Indicates a hazardous situation that, if not avoided, could result in death or serious injury.
CAUTION	Indicates a hazardous situation that, if not avoided, could result in minor or moderate injury.
NOTICE	Indicates a hazard that, if not avoided, could result in property damage.
Note	Indicates important information that you should take into account to avoid malfunctions.

Symbol	Description
Tip	Indicates tips that can make your work easier.
	Indicates a link that refers to a definition in the glossary, which you can find at the end of the document unless stated otherwise.
	Precedes the document title in a link that refers to another document.

Naming conventions

dSPACE user documentation uses the following naming conventions:

%name% Names enclosed in percent signs refer to environment variables for file and path names.

< > Angle brackets contain wildcard characters or placeholders for variable file and path names, etc.

Special folders

Common Program Data folder A standard folder for application-specific configuration data that is used by all users.

```
%PROGRAMDATA%\dSPACE\<InstallationGUID>\<ProductName>
```

or

```
%PROGRAMDATA%\dSPACE\<ProductName>\<VersionNumber>
```

Documents folder A standard folder for user-specific documents.

```
%USERPROFILE%\Documents\dSPACE\<ProductName>\
<VersionNumber>
```

Local Program Data folder A standard folder for application-specific configuration data that is used by the current, non-roaming user.

```
%USERPROFILE%\AppData\Local\dSPACE\<InstallationGUID>\
<ProductName>
```

Accessing dSPACE Help and PDF Files

After you install and decrypt dSPACE software, the documentation for the installed products is available in dSPACE Help and as PDF files.

dSPACE Help (local) You can open your local installation of dSPACE Help:

- On its home page via Windows Start Menu
- On specific content using context-sensitive help via **F1**

dSPACE Help (Web) You can access the Web version of dSPACE Help at www.dspace.com/go/help.

To access the Web version, you must have a *mydSPACE* account.

PDF files You can access PDF files via the icon in dSPACE Help. The PDF opens on the first page.

Basics and Instructions

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Using MotionDesk for Sensor Simulation Control

Introduction

You can use MotionDesk to configure Sensor Simulation hardware connections and control the camera and laser sensors for sensor simulation.

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Connecting Sensor Simulation Hardware and Tools

Introduction

You can use MotionDesk to manage the sensor simulation hardware and SensorSim application connections.

Sensor Simulation hardware

You can add and configure the SensorSim application and hardware you use in your sensor simulation environment.

SensorSim application The SensorSim application generates the data for ADAS/AD sensors that are integrated into a sensor simulation architecture.

The SensorSim application uses the graphics processing unit of the SensorSim PC to generate the raw graphic image data, point cloud image, target list, or object list data for insertion into a the sensor ECU processors or to be displayed on a screen.

The application and download of the scene to the SensorSim application is controlled by MotionDesk.

In raw data simulation, the Environment Sensor Interface Unit (ESI) inserts the data into the sensor hardware processors in a hardware-in-the-loop architecture or into the sensor algorithms in a software-in-the-loop environment.

The rendered image data can also be displayed in a MotionDesk sensor composition window on a dedicated screen for over-the-air simulation (OTA).

Environment Sensor Interface Unit (ESI) An interface unit that gets the sensor data from the SensorSim application and inserts it into the sensor ECU processors. For example, in a raw data simulation ,the data can be inserted into a camera image processor or a laser sensor point cloud generator.

The Environment Sensor Interface Unit is an FPGA unit that splits the raw data or object and target list data that is required for each of the sensors in the sensor simulation architecture. It can also convert the data into a format for the sensor that is not supported by MotionDesk, for example, a 16 bit Bayer pattern.

The Environment Sensor Interface Unit then forwards synchronized raw data to the relevant sensor though a variety of interfaces via the Environment Sensor Interface Unit plug-on device (POD).

Related topics

Basics

Configuration of SensorSim Application Connections..... 85
Environment Sensor Interface Unit (Sensor Simulation Overview 🕮)
Overview of Sensor Simulation (Sensor Simulation Overview 🕮)
SensorSim Application (Sensor Simulation Overview 🕮)

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Overview of Configuring Sensors in MotionDesk

Introduction

In MotionDesk you add and configure different sensors to the vehicle environment to generate the sensor data for sensor simulation.

Sensor overview

You can add the following sensors to the vehicle in the simulation to generate the data to use in your sensor simulation environment.

- Camera sensor
- Fish-eye sensor
- Laser sensor
- Lidar sensor
- Radar sensor

Note

You must install the correct licenses for each sensor type you use.
For more information, refer to Licenses for Sensor Simulation (Sensor Simulation Overview)

You can add camera, fish-eye camera, lidar, and radar sensors to the ego-vehicle under test in a MotionDesk scene. Typically, you assign the motion data of the vehicle chassis to the sensors, so the sensors move together with the vehicle. The sensor position can be further defined relative to the vehicle chassis. More properties are available to configure the characteristics of the sensors.

You can view the animation in the MotionDesk 3-D view or from the perspective of the camera or fish-eye sensor in a dedicated sensor composition window.

The composition window for the radar and lidar sensors displays data in a binary format, which is typically transferred to an Environment Sensor Interface Unit (ESI) or to a Virtual Environment Sensor Interface (V-ESI).

When you work with SensorSim applications, you can download the MotionDesk scene including the configured sensors to the SensorSim application. The SensorSim applications process and render the data similar to MotionDesk. Real-time postprocessing can also be applied to the generated data before the data is displayed in a composition window or output to shared memory..

Camera and fish-eye sensors

You can configure the properties of the camera and fish-eye sensors, for example, the size and position of the sensor in relation to the vehicle. You can also configure the focal length, crop factor, and the field of view, which can be displayed in the MotionDesk 3-D view. You can also simulate distortions and optical effects of the sensor lens. For more information, refer to Basics on Lens Distortion Effects on page 37.

You can also implement a routine for image data postprocessing.

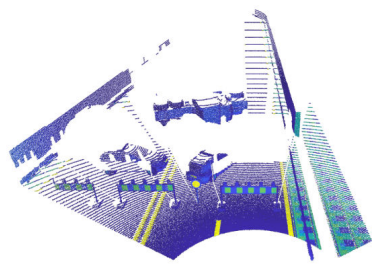
Laser sensors

You can configure the properties of the laser sensor, for example, the size and position of the sensor, in relation to the vehicle. You can also control the field of view and the point cloud properties of the laser, which can be displayed in the MotionDesk 3-D view. You can select a number of laser sensor output modes for the sensor data. You can preview the sensor view output modes in the composition window.

Lidar sensors

Lidar sensors transmit short light pulses that reflect off objects in the environment and return to the sensor receivers. The reflected signals provide information about the environment, for example, the distance, angle, and the relative speed of the objects within the field of view of the sensor.

Most lidar sensors use infrared light with a wavelength at 905 or 1550 nm so they can reflect off spots on the objects to generate a high-precision 3-D point cloud model of the environment. An example of a 3-D point cloud is as follows:



You can configure the properties of the lidar sensor, for example, the position and orientation of the sensor in relation to the vehicle. You can also control the field of view and the point cloud properties of the sensor, which can be displayed in the MotionDesk 3-D view. You can add multiple sensor instances for each sensor and select a number of output modes for the sensor data.

For more information on working with lidar sensors, refer to the **MotionDesk Lidar Sensor Module** documentation.

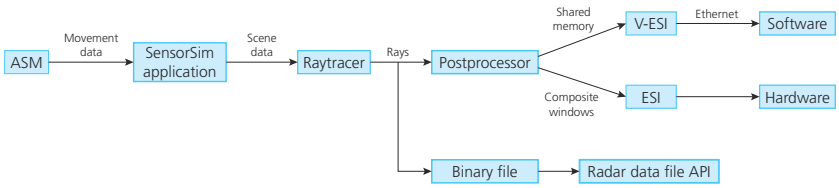
Radar sensors

Radar sensors transmit short electro-magnetic radio waves that reflect off objects in the environment and return to the sensor receivers. The reflected signals provide information on the environment, for example, the distance, angle, and the relative speed of the objects within the field of view or range of the sensor. The propagation of the radio waves can be simulated as rays.

The wavelength of the electromagnetic radiation is much smaller than typical distances and dimensions of the objects in the scene. Typical frequencies for radar sensors are: 24 GHz and 76 to 81 GHz. The light's interaction with materials must be described in detail and separately for each wavelength.

You can configure the properties of the radar sensor, for example, the number of radar rays and the field of view cone size for the sensor. You can also add multiple antennas for each radar sensor.

An example of the data flow for a radar sensor is as follows:



Transmitted radar rays react depending on the characteristics of the environment. The GPU ray tracer on the SensorSim PC calculates the **channel impulse response** from the environment. This is based on ray-tracing algorithms.

The Postprocessor is used to manipulate the sensor data for the required output. Specific radar sensor data can also be calculated from this channel impulse response base.

For more information on working with radar sensors, refer to the **MotionDesk Radar Sensor Module** documentation.

Related topics

Basics

Configuration of Camera and Fish-Eye Sensors.....21
Configuration of Laser Sensors.....70
Configuring Lidar Sensors (MotionDesk Lidar Sensor Module 🕮)
Configuring Radar Sensors (MotionDesk Radar Sensor Module 🕮)
Introduction to Sensor Simulation (Sensor Simulation Overview 🕮)

Downloading a MotionDesk Scene

Introduction

In MotionDesk, you can download the MotionDesk scene data to the SensorSim application to process sensor simulation data.

MotionDesk scene download

You must add the sensors in the MotionDesk scene and adjust the sensor properties.

You then download the scene to the selected SensorSim application that is specified in the properties for each sensor.

The MotionDesk scene data is downloaded to the folder structure for the SensorSim application that you specify in the SensorSim.ucd configuration file.

For more information on the UCD file and the monitoring service, refer to How to Configure the SensorSim Application Settings File (Sensor Simulation Manual 🕮) and SensorSim Application Configuration Settings (Sensor Simulation Manual 🕮).

Note

The SensorSim application instance must be running on the SensorSim PC. You must also add a connection to the application in MotionDesk.

The SensorSim application calculates and renders the images of the environment for the sensors. The raw data is then passed to the Environment Sensor Interface Unit hardware, which inserts the raw data into the specified sensor hardware.

Related topics

Basics

Configuration of SensorSim Application Connections.....85
Environment Sensor Interface Unit (Sensor Simulation Overview 🕮)
Overview of Sensor Simulation (Sensor Simulation Overview 🕮)
SensorSim Application (Sensor Simulation Overview 🕮)

HowTos

How to Configure the SensorSim Application Settings File (Sensor Simulation Manual 🕮)

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Using MotionDesk Scene Animations for Sensor Simulation

Introduction

You can use MotionDesk to display the scene animation on screen and to produce the raw data for the sensor simulation.

Sensor simulation scene animation

You can display the MotionDesk 3-D scene animation on a single PC or on multiple PCs. You can select to display multiple observer views on each screen to see the sensor simulation in the scene. For more information, refer to How to Configure the MotionDesk Displays (MotionDesk Scene Animation 🕮).

In the sensor properties, you can select to display the sensor, and the sensor field of view or laser point cloud in the 3-D view.

Sensor simulation composition window

You can also display a preview of the simulated sensor data in a composition window. The composition window displays the MotionDesk scene from the view of the sensors.

The field of view, output mode, and lens distortions that you specified in the sensor properties are displayed.

Sensor simulation options

You can also use the animation to create the data for sensor simulation.

Validation options

- Over-the-air simulation (OTA): Use a screen and a hardware-in-the-loop environment for sensor simulation. You point the camera or fish-eye sensor lens directly at the screen that displays the MotionDesk 3-D scene animation in the composition window.

- Raw data simulation: Use MotionDesk to download the scene to the SensorSim application for calculation and rendering. The raw data produced is then inserted into the sensor data processing modules behind the sensor front end.

For more information, refer to Sensor Simulation Sensor Data Input Scenarios (Sensor Simulation Overview 🕮).

Related topics

Basics

How to Configure the MotionDesk Displays (MotionDesk Scene Animation 🕮)
Overview of Sensor Simulation (Sensor Simulation Overview 🕮)
Sensor Simulation Sensor Data Input Scenarios (Sensor Simulation Overview 🕮)
Working with Observers (MotionDesk Scene Animation 🕮)

Using Animated Characters in Sensor Simulation

Introduction

You can use animated characters for all sensors in sensor simulation.

Animated characters

To work with animated characters, for example, a person walking or cycling in MotionDesk and Sensor Simulation, you must install the **MotionDesk Animated Characters** license.

Animated 3-D characters are rendered and supported by the SensorSim application for all sensor types in sensor simulation.

If the license is not available or missing, the animated characters you add to the scene or that exist in an existing project are not rendered in the scene. A message is displayed in the MotionDesk **Messages** pane.

Tip

Dummy characters can be used without the animated characters license.

For more information on animated characters, refer to: Basics of Using Animated Characters in the Scene (MotionDesk Scene Animation 🕮).

Related topics

Basics

Basics of Using Animated Characters in the Scene (MotionDesk Scene Animation 🕮)

HowTos

How to Use Animated Characters in MotionDesk (MotionDesk Scene Animation 🕮)

Using the Model and Sensor Interface Blockset

Introduction

You must use the Model and Sensor Interface Blockset to connect the vehicle simulation to MotionDesk and Sensor Simulation connected systems and applications.

Model and Sensor Interface Blockset

You must use the Model and Sensor Interface Blockset to validate sensors during sensor simulation.

dSPACE provides the Model and Sensor Interface Blockset to build Simulink models to calculate and handle the transmission of simulation, status, feedback, and failure data between the simulation and Sensor Simulation connected systems and applications. For example, you can connect MotionDesk for the visualization of the sensor simulation and a SensorSim application that renders the sensor data for over-the-air or raw data sensor simulations. An Environment Sensor Interface Unit can also be connected that splits the sensor data and inserts it into the relevant sensor hardware.

This blockset also provides a feedback loop to provide sensor and status information. Sensor failures can also be transmitted.

Related topics

Basics

Working with the Model and Sensor Interface Blockset (Model and Sensor Interface Blockset Manual 🕮)

How to Configure a MotionDesk Screen for Sensor Simulation

Objective

To display the sensor simulation image for each sensor in a composition window, you must select the screen in the MotionDesk options for the composition window.

Overview

In sensor simulation, you can display the scene as viewed by the sensors in a sensor composition window. For example, you can display the view of a camera sensor for over-the-air simulations on a dedicated display screen. If you have multiple sensors, the output for all connected sensors is combined in the sensor composition window.

Tip

You can also configure multiple SensorSim application instances and download the scene to them. Each instance can have a dedicated screen. You can then assign each sensor to an instance. For more information, refer to Multi-Instancing of the SensorSim application (Sensor Simulation Manual 🕮).

One display screen attached If you have one connected display screen, the sensor composition window is displayed on that screen. When you click View - Single Full screen or F11 the MotionDesk animation of the simulation is shown on the screen over the top of the sensor composition window. You can press Esc to close Single Full screen mode.

Multiple display screens attached If you have multiple display screens, you can select a display screen in the MotionDesk options for the sensor simulation composition window and for the MotionDesk full and split screen modes. If required, you can also select the same screen.

Note

Sensor Simulation display
The display screens can be used for sensor simulation and for single and split screen mode simultaneously.

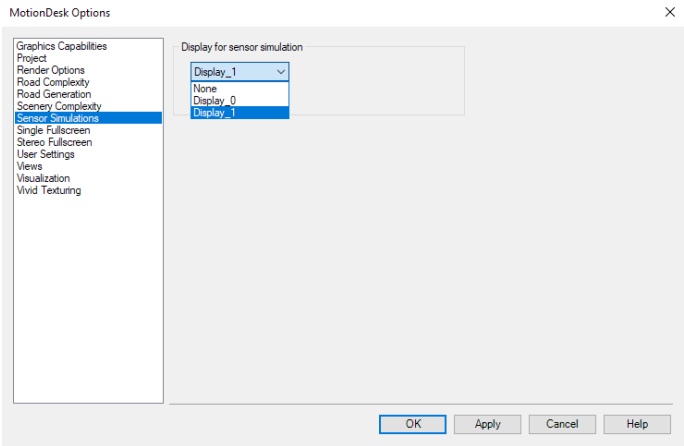
Note

It is recommended that both displays have the same screen resolution and the same settings for the size of text and other items. If these settings differ, the display for the camera sensor can only show part of the view for the sensor.

Method

To configure a MotionDesk screen for sensor simulation

1 On the File ribbon, click Options to open the MotionDesk Options dialog and click Sensor Simulations.



2 In the list, select the display screen to display the sensor composition window for sensor simulation.

   Click OK to close the dialog.

3 In the Scene Navigator, select Enable Sensor Simulation in the Sensors context menu.

4 Select Play in the Motion Player or start a simulation.

   The sensor composition window shows the views of the enabled sensors on the selected display screen. If you have not enabled a sensor, the composition window is empty.

5 Stop the simulation or close the sensor composition window by selecting Open/Close Composition Window in the Sensors context menu.

Tip

If you selected the same screen for sensor simulation and MotionDesk, the composition window opens on the same screen. MotionDesk is hidden behind the composition window. You can switch back to MotionDesk by pressing **`Alt+Tab`** or by using the Windows taskbar.

Result

You selected a display screen for the sensor composition window to display the sensor data for sensor simulation.

Related topics

HowTos

How to Configure a Stereo Display (MotionDesk Scene Animation 🕮)
How to Configure Full Screen Mode with Multiple Displays (MotionDesk Scene Animation 🕮)

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Configuration of Camera and Fish-Eye Sensors

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You can use MotionDesk to add and configure camera and fish-eye sensors in the scene to use in sensor simulation.

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How to Change the Camera and Fish-Eye Sensor Field of View.....35
You can change the field of view of the camera and fish-eye sensors to adjust the view that the sensor captures and uses in the simulation.

Basics of the MotionDesk Camera and Fish-Eye Sensors

Introduction

In MotionDesk, you can insert camera and fish-eye sensors into the scene and provide an image or raw data for sensor simulation. You can control the sensor representation, lens properties and lens optical effects in the properties.

Required license

To download scenes that contain camera or fish-eye sensors to the SensorSim application and use with sensor simulation, you must activate the MDD_SENSOR_CAMERA license.

In MotionDesk, you can create and configure any number of camera, fish-eye, and laser sensors using the basic MotionDesk license.

Note

Sensor license activation
If you have not activated the licenses for each sensor type that you added to the scene in the 3-D View, all sensors in the scene are deactivated. The sensors are reactivated when you install and activate the licenses.

For more information, refer to Licenses for Sensor Simulation (Sensor Simulation Overview 🕮)

Screen display for the camera and fish-eye sensors

The MotionDesk PC should have at least two screens:

One display can be used for the MotionDesk scene and another for the sensor output in the composition window. You can follow the simulation from the perspective of the camera or fish-eye sensor. Sensor Simulation must be enabled and the Composition Window opened.

You must select the display used for the composition window in the MotionDesk options. For more information, refer to How to Configure a MotionDesk Screen for Sensor Simulation on page 18.

Note

It is recommended that both displays have the same screen resolution and the same settings for the size of text and other items. If these settings differ, the display preview for the laser sensor can only show part of the view for the sensor.

Sensor overview

You can insert camera and fish-eye sensors into a scene and edit the lens and display properties.

Sensors

- A camera sensor produces a standard angle of view of the environment using a rectilinear lens.

  The field of view is typically a maximum of 100 degrees with a technical maximum of 180 degrees. Radial lens distortion can occur beyond 100 degrees. It is not recommended to exceed 140 degrees.
- A fish-eye sensor produces a wide angle of view that can exceed 180 degrees in all directions. The distortion increases towards the edges of the image.

  Fish-eye sensors are typically used in sensor simulation to provide a view of between 100 and 220 degrees of the sensor environment. The technical maximum is 360 degrees.

The sensors provide an image of the scene from the perspective of the camera or fish-eye lens in the simulation. The sensors can be attached to the vehicle motion data from the simulation. You can download the scene to the SensorSim application to render and display the data in the sensor composition window for over-the-air simulations or to insert into the sensor hardware.

Sensor properties overview

Sensor representation The camera and fish-eye sensors are displayed as a 3-D box representation in the scene in the 3-D View. You can specify the position, orientation, size and color of the sensors in the properties, or disable the representation entirely. The sensor's absolute position is derived from the motion data that is attached to it. It can be offset from this position in the position properties.

The sensor frustum is also visible. See Sensor Frustum.

Sensor field of view The field of view is the area that is monitored by the camera and fish-eye sensors. The field of view is controlled by the sensor resolution. You can also edit the near point of the sensor.

Sensor Frustum The field of view of the sensor is displayed by a frustum in the MotionDesk scene. You can specify the appearance of the frustum by specifying the line color and width.

The frustum of a camera sensor is shown as a pyramid. For a fish-eye sensor, the frustum has a circular shape. The frustum is an approximation of the actual visibility of the sensor.

Lens configuration and distortions You can also specify camera optical distortion effects for sensor simulation. For more information, refer to Basics on Lens Distortion Effects on page 37.

Related topics

Basics

Basics of a Camera Sensor View 24
Basics of a Fish-Eye Sensor View 26

Licenses for Sensor Simulation (Sensor Simulation Overview 🕮)
Overview of Sensor Simulation (Sensor Simulation Overview 🕮)

HowTos

How to Configure a MotionDesk Screen for Sensor Simulation..... 18
How to Insert a Camera Sensor..... 28

References

Camera and Fish-Eye Sensor Properties..... 132

Basics of a Camera Sensor View

Introduction

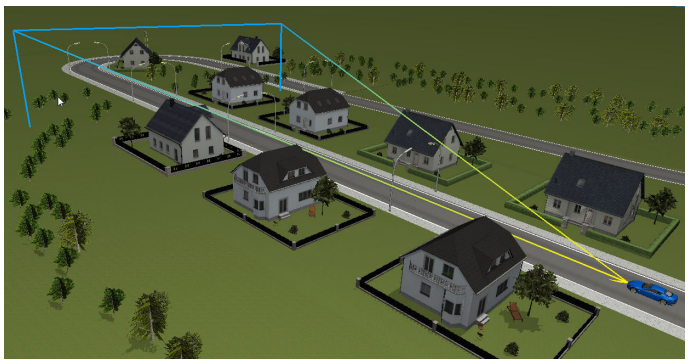
MotionDesk can display the frustum of the camera sensor in the scene in the 3-D View. The actual field of view from the perspective of the sensor can also be adjusted in the properties. The scene from the perspective of the sensor is shown in the composition window.

Overview

The properties of the camera sensor that you specified are shown in the scene in the MotionDesk 3-D View. This includes the size of the field of view, which is a guide for the area the sensor monitors in the scene.

The composition window displays the perspective from the sensor in the simulation. The properties you set for the camera sensor are reflected in the output image.

3-D view frustum The position, orientation and field of view of the camera sensor is displayed as a pyramid frustum in the observer view of the MotionDesk scene. See the following example of the MotionDesk scene.

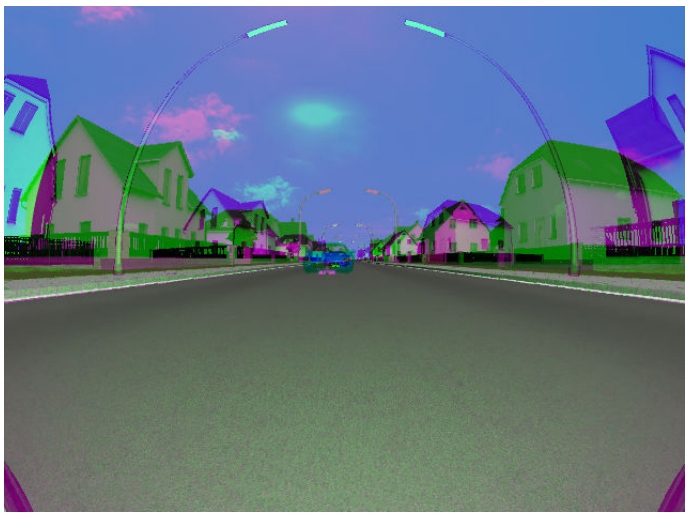


Composition window view The field of view area that is captured by the camera sensor is displayed on the second screen in a composition window. In an over-the-air simulation, you can place the real camera sensor in front of the

display and MotionDesk shows it the driving scene from the specified position. The following illustration shows the image for the real camera sensor in the composition window.

Optical lens effects It is also possible to simulate the lens distortion. This means, it is not necessary to use the lens of the real camera sensor during the validation of the camera sensor. The test setup can be smaller and many real life scenarios can be more efficiently tested.

For the purpose of illustration, the following image of a MotionDesk camera sensor shows radial lens distortion and extreme chromatic aberration effects. You can specify several properties to validate different camera optical effects and lens conditions. For more information, refer to Basics on Lens Distortion Effects on page 37.



Related topics

Basics

Basics on Lens Distortion Effects..... 37

HowTos

How to Insert a Camera Sensor..... 28

References

Camera and Fish-Eye Sensor Lens Configuration Properties..... 137
Camera and Fish-Eye Sensor Properties..... 132

Basics of a Fish-Eye Sensor View

Introduction

MotionDesk can display the frustum of the fish-eye sensor in the 3-D scene in the 3-D View. The actual field of view from the perspective of the sensor can also be adjusted in the properties. This view is displayed in the composition window.

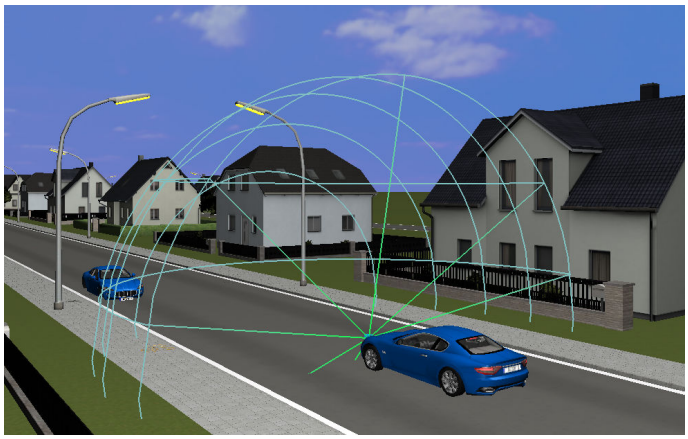
Overview

The properties of the fish-eye sensor that you specified are shown in the scene in the MotionDesk 3-D View. This includes the size of the field of view, which is a guide for the area the sensor monitors in the scene.

The composition window displays the perspective from the sensor in the simulation. The properties you set for the fish-eye sensor are reflected in the output image.

View frustum The position, orientation and field of view of the fish-eye sensor is displayed as a spherical frustum in the observer view in the 3-D View. This frustum is an approximation and does not represent the exact visibility of the sensor.

See the following example of the MotionDesk 3-D View.

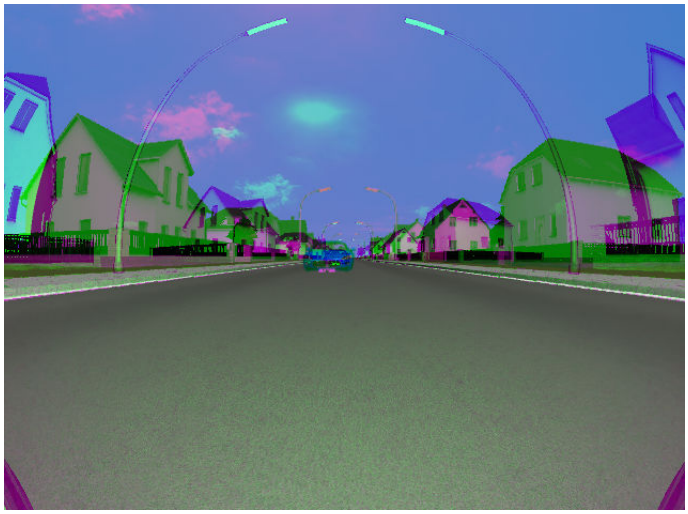


Composition window view The field of view area that is captured by the fish-eye sensor is displayed on the screen in a composition window.

The following illustration shows the image for the real fish-eye sensor in the composition window.

Optical lens effects It is also possible to simulate the lens distortion. This means, it is not necessary to use the lens of the real fish-eye sensor. The test setup can be smaller and many real life scenarios can be more efficiently tested.

The following illustration shows the image of the real fish-eye sensor with chromatic aberration distortion effects. For more information, refer to Basics on Lens Distortion Effects on page 37.



Related topics

Basics

Basics on Lens Distortion Effects..... 37

HowTos

How to Insert a Fish-Eye Sensor..... 30

References

Camera and Fish-Eye Sensor Lens Configuration Properties..... 137
Camera and Fish-Eye Sensor Properties..... 132

How to Insert a Camera Sensor

Objective

You can insert a camera sensor into the MotionDesk scene in the 3-D View and view the output of the camera sensor.

Precondition

- A display screen for sensor simulation must be configured for the camera sensor. Refer to How to Configure a MotionDesk Screen for Sensor Simulation on page 18.
- The MotionDesk experiment should be ready for animation. This means, the scene is created and the movable objects are assigned to motion data.

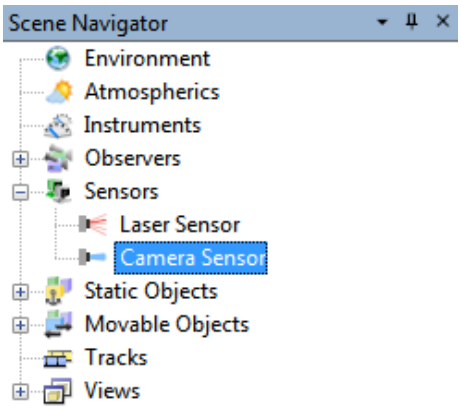
Method

To insert a camera sensor

1 In the Scene Navigator, right-click on the Sensors node and select Create Camera Sensor in the context menu.

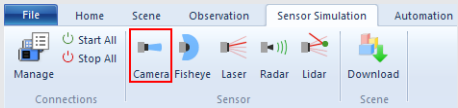
MotionDesk adds a new camera sensor. This is displayed in the tree.

The sensor is enabled by default.



Tip

You can also select Camera on the Sensor Simulation ribbon to add a new camera sensor.



2 In the Scene Navigator, right-click on the Sensors node and select Enable Sensor Simulation in the context menu.

3 In the Scene Navigator on the Sensors node, select Open/Close Composition Window in the context menu.

The composition window opens. You can observe the scene in the 3-D View as seen by the camera sensor.

4 In MotionDesk, select the Open/Close Composition Window button in the Sensor properties pane to close the composition window.

Result

A camera sensor is created. You viewed the frustum in the 3-D View and the field of view as seen by the camera sensor in the composition window.

Related topics

Basics

Basics of the MotionDesk Camera and Fish-Eye Sensors..... 22

HowTos

How to Configure a MotionDesk Screen for Sensor Simulation..... 18

References

Create Camera Sensor..... 116

How to Insert a Fish-Eye Sensor

Objective

You can insert a fish-eye sensor to the MotionDesk scene in the 3-D View and view the output of the fish-eye sensor.

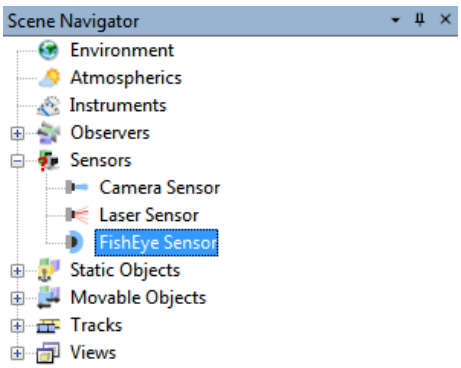
Method

To insert a fish-eye sensor

1 In the Scene Navigator, right-click on the Sensors node and select Create Fish-eye Sensor in the context menu.

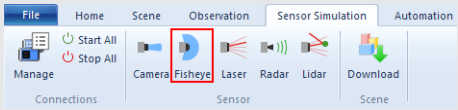
MotionDesk adds a new fish-eye sensor. This is displayed in the tree.

The sensor is enabled by default.



Tip

You can also select Fish-eye on the Sensor Simulation ribbon to add a new fish-eye sensor.



2 In the Scene Navigator, right-click on the Sensors node and select Enable Sensor Simulation in the context menu.

3 In the Scene Navigator on the Sensors node, select Open/Close Composition Window in the context menu.

The composition window opens. You can observe the scene in the 3-D View as seen by the fish-eye sensor.

4 In MotionDesk, select the Open/Close Composition Window button in the Sensor properties pane to close the composition window.

Result

A fish-eye sensor is created. You viewed the frustum in the 3-D View and the field of view as seen by the camera sensor in the composition window.

Related topics

Basics

Basics of the MotionDesk Camera and Fish-Eye Sensors..... 22

References

Create Fish-Eye Camera Sensor..... 117

How to Assign Motion Data to the Sensor

Objective

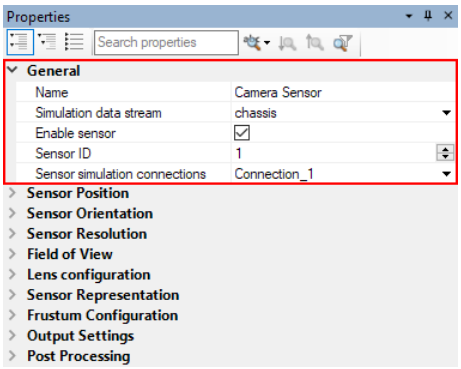
You can assign motion data from the simulation to the sensor.

Method

To assign motion data to the sensor

1 In the Scene Navigator, select the camera or fish-eye sensor.

The Properties pane that follows displays the properties of the camera sensor.



2 In the General category, select a Simulation data stream for the camera sensor. The camera sensor usually moves with the `chassis`.

Note

If the Simulation data stream for the sensor is `Not Connected` or `<Inertial>`, the output is not displayed in the composition window and the sensors do not move with the objects.

3 You must select Enable sensor to display the sensor frustum in the 3-D View and include it in the sensor simulation output.

4 Start the simulation on the Home ribbon or select play in the Motion Player to display the animation.

The composition window opens and displays the sensor output view moving with the motion data.

5 Stop the animation or the Motion Player.

Result

You assigned motion data to the sensor and viewed the default output in the composition window.

Related topics

References

Camera and Fish-Eye Sensor Properties..... 132
Common Sensor Properties..... 130

How to Change the Sensor Size, Position, Orientation, and Frustum

Objective

You can change the properties of the camera and fish-eye sensors, for example, the 3-D representation, position, orientation, and the frustum that displays a representation of the field of view in the scene in the 3-D View.

Method

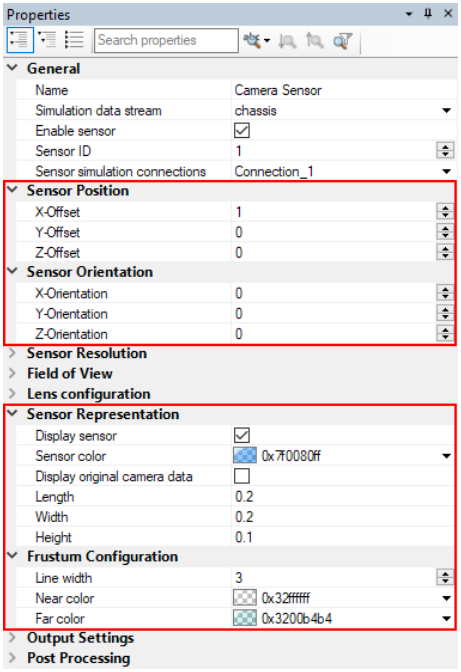
To change the sensor size, position, orientation, and frustum

1 Select a free observer and move to the sensor in the scene in the 3-D View.

> **Tip**
>
> When the sensor is assigned to the motion data of the chassis, click the 3-D object of the chassis in the Scene Navigator and select Fly to Object from the context menu. The free observer is moved to the chassis and to the sensor. You can move the free observer to a more convenient position.

2 Select the Camera Sensor or Fish-eye Sensor in the Scene Navigator tree to display the Properties pane.

The Properties pane that follows displays the properties of the camera sensor.



You can now change the basic sensor settings.

When you modify these properties, MotionDesk immediately updates the MotionDesk observer view and the image in the composition window.

3 In the Sensor Position category, specify the offset values. These offset values are related to the point specified by the simulation data stream. For example, you can change the position of the sensor in relation to the car chassis.

4 In the Sensor Orientation category, specify angles for the orientation of the sensor in relation to the car chassis, for example, to capture the image from the rear of the car.

5 In the Sensor Representation category, you can change the characteristics of the sensor that is displayed in the 3-D view:

- Select Display sensor to display the sensor frustum in the scene in the 3-D View.
- Select Sensor color to change the color of the sensor unit that is attached to a data stream.
- Select Sensor Size to change the size of the sensor unit that is attached to a data stream.
- Select Display the original camera data (Camera sensor only) to display the camera's output at the end of the frustum in the scene in the 3-D View.

6 In the Frustum Configuration category, you can change the frustum line width and colors that are displayed in the 3-D view.

The frustum of a camera sensor is displayed as a pyramid. For a fish-eye sensor, the frustum is a dome shape.

Tip

These properties have no effect on the sensor output in the composition window. They are used to adjust the position and orientation of the sensors in relation to other objects in the scene.
During the simulation or tests, you can clear the Display sensor property in Sensor Representation to animate the scene in the 3-D View without the frustum. This has no effect on the sensor simulation.

7 Start the simulation to visualize the basic camera settings changes in the animation and composition window.

Result

You changed the basic camera and fish-eye settings and viewed the sensor and the frustum in the 3-D View.

Related topics

References

Camera and Fish-Eye Sensor Properties..... 132
Common Sensor Properties..... 130

How to Change the Camera and Fish-Eye Sensor Field of View

Objective

You can change the field of view of the camera and fish-eye sensors to adjust the view that the sensor captures and uses in the simulation.

Precondition

The sensor must be enabled for sensor simulation and displayed in the 3-D scene in the 3-D View. Motion data must be assigned to the sensor. For information refer to How to Assign Motion Data to the Sensor on page 32.

Overview

The field of view is the area that is captured by the sensor and that is displayed in the sensor simulation composition window.

Field of view calculation

The horizontal and vertical field of view angle is controlled by the **sensor resolution**, **focal length**, and **crop factor** properties and the *Geometric Distortion Model for Rectilinear Lenses* or the *Geometric Distortion Model for Fish-eye Lenses*.

For more information, refer to How to Load an Adobe Lens Correction Profile on page 44.

When you modify the field of view, MotionDesk immediately updates the MotionDesk observer view and the image in the **composition window**.

Method

To change the sensor field of view

1. Select the **Camera Sensor** or **Fish-eye sensor** in the **Scene Navigator** tree to display the **Properties** pane.
2. Right click on the Sensor in the **Scene Navigator** tree and select **Open/close composition window** to display the sensor view of the scene and display the field of view changes.

   Tip

   To work with MotionDesk and also display the composition window, you can select a different display for Sensor Simulation. For more information, refer to How to Configure a MotionDesk Screen for Sensor Simulation on page 18

3. In the **Lens Configuration** category, reduce the **Focal length** and view the changes in the composition window.

   The field of view properties change. The field of view is wider but displayed at a lower magnification.
4. In the **Lens Configuration** category, increase the **Crop factor** to 2 and view the changes in the composition window.

The field of view properties change. The field of view is narrower.

Note

Reducing crop factor or focal length by the same factor has the same effect. Therefore, you need only to change focal length.

5 In the **Sensor Resolution** category, change the **X-Resolution** and **Y-Resolution**.

The sensor resolution changes the field of view angles. The changes are shown in the composition window. For example, if you increase the **X-Resolution**, the **Horizontal** field of view angle increases.

Result

You have changed the camera and fish-eye field of view using the sensor properties and viewed the field of view in the **composition window**.

What's next

You will learn the basics of camera and fish-eye optical effects. Refer to Basics on Lens Distortion Effects on page 37.

Related topics

Basics

Basics on Lens Distortion Effects 37

HowTos

How to Assign Motion Data to the Sensor 32
How to Configure a MotionDesk Screen for Sensor Simulation 18
How to Load an Adobe Lens Correction Profile 44

References

Camera and Fish-Eye Sensor Lens Configuration Properties 137
Camera and Fish-Eye Sensor Properties 132
Common Sensor Properties 130

Configuration of Camera and Fish-Eye Lens Distortions

Introduction

You can use MotionDesk to configure camera and fish-eye sensor lens distortions for sensor simulation.

Where to go from here

Information in this section

Basics on Lens Distortion Effects.....37
In MotionDesk, you can control the type of camera lens distortion effects for sensor simulation.

How to Select a Lens Distortion Look-Up Table.....41
In the MotionDesk camera and fish-eye sensor properties, you can select lens distortion configurations from a look-up table.

How to Load an Adobe Lens Correction Profile.....44
You can load an Adobe lens correction profile from an Adobe file. The application reads the file that can adjust the lens field of view and add distortions coefficients.

How to Manually Specify Adobe Lens Distortions.....46
In MotionDesk, you can manually specify Adobe lens distortion corrections in the sensor properties pane.

Working with Adobe Lens Radial Distortions.....48
In the MotionDesk camera and fish-eye sensor properties, you can configure Adobe lens radial distortions in a polynomial coefficient dialog. The SensorSim application renders the distortions based on these settings.

How to Specify Polynomial Configurations for Adobe Lens Radial Distortions.....51
In the MotionDesk camera and fish-eye sensor properties, you can specify the polynomial configurations for the radial distortions. The SensorSim application renders the distortions based on the settings.

Basics on Lens Distortion Effects

Introduction

In MotionDesk, you can control the type of camera lens distortion effects for sensor simulation.

Lens distortion effects

During sensor simulation, camera and lens conditions such as image distortions, lens effects can easily be validated. You can use MotionDesk to adjust the properties for each camera or fish-eye sensor. You can control a number of lens

effects and distortions to be displayed on screen for over-the-air simulation or to be used for raw data simulation.

This sensor simulation technique eliminates the need for a large test bench, because it is easy to simulate lens conditions and limitations that would be difficult to recreate on a real test bench.

You can also activate postprocessing to carry out additional custom image alterations, such as pixel failure by programming a routine in C++. For further information, refer to Postprocessing the Images of Camera and Fish-Eye Sensors on page 63.

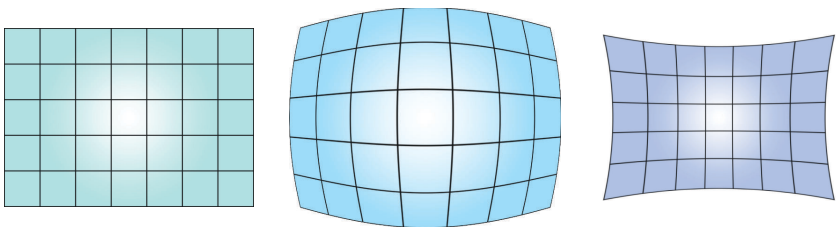
Radial lens distortion Radial lens distortion is an image distortion where the straight lines of an object appear to be curved. It can be classified into the following types:

- Barrel: An image distortion effect where the image magnification decreases the farther you move away from the center of the image. In barrel distortion, lines that are actually straight curve outward. The image appears to bulge outward.

  A fish-eye lens has a very wide angle of view that can exceed 180 degrees in all directions. A fish-eye lens is recommended for field of views above 100 degrees. It creates a panoramic or spherical image with a barrel distortion effect. The edges of the fish-eye image are distorted. For more information, refer to fish-eye sensor.

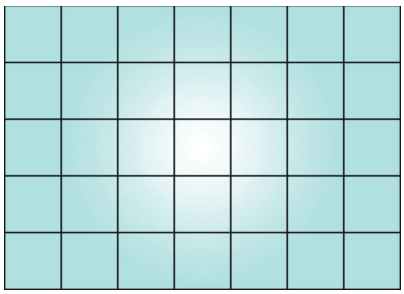
  A rectilinear Lens has a regular angle of view of up to 100 degrees. It produces an image that matches the image viewed by the human eye. It is also know as perspective lens. It is therefore recommended for smaller field of views.
- Pincushion: The opposite of barrel lens distortion. Pincushion distortion is an imaging effect where the image magnification increases the farther you move away from the center of the image. In pincushion distortion, lines that are actually straight curve inward. Telephoto lenses are used to create this effect.

The following illustration show the effects of no distortion, barrel distortion and pincushion distortion.

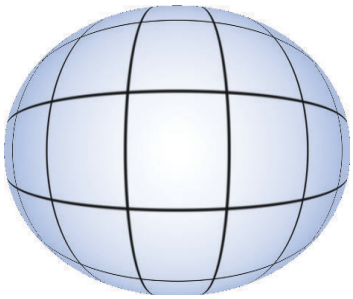


No distortion Barrel distortion Pincushion distortion

The following illustration show the effects of a fish-eye lens in comparison with no distortion.



Normal



Fish-eye

The following illustration show the effects of no distortion, barrel distortion, and pincushion distortion.

No distortion

Barrel distortion

Pincushion distortion

The following illustration show the effects of a circular fish-eye lens in comparison with a regular image without distortion. The lens captures an image with a field of view of 180 degrees. The image is circular and appears to bulge outwards. The edges of the frame are black.

Regular

Fish-eye

Vignetting Vignetting is an image distortion effect where the brightness or saturation of an image is reduced around the edges, in comparison to the image

center. It can be caused by lens or camera limitations, or by lens interference. The image borders are darker.

Refer to the following examples:

No vignetting

Vignetting

Chromatic aberration Chromatic aberration is an image distortion effect where there is a dispersion of light colors due to different indices of refraction of light of different wavelengths. The image is blurred with a rainbow effect between dark and bright areas of the image. This is due to a failure of the lens to focus all the colors to the same convergence point in the camera image sensor chip.

Refer to the following examples:

No chromatic aberration

Chromatic aberration

What's next

You will learn how to configure lens distortion effects in the MotionDesk scene. Refer to How to Load an Adobe Lens Correction Profile on page 44.

Related topics

HowTos

How to Load an Adobe Lens Correction Profile..... 44
How to Manually Specify Adobe Lens Distortions..... 46

References

Camera and Fish-Eye Sensor Lens Configuration Properties..... 137

How to Select a Lens Distortion Look-Up Table

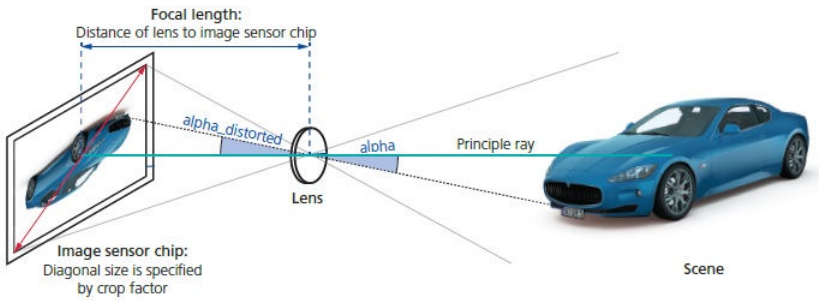
Introduction

In the MotionDesk camera and fish-eye sensor properties, you can select lens distortion configurations from a look-up table.

Overview of the look-up table

In the MotionDesk lens configuration properties for camera and fish-eye sensors, you can select a look-up table, which must be in CSV format, that defines the lens distortions.

The look-up-table specifies the relationship between the `undistorted` angle `(alpha)` to the objects in the scene in front of lens and the `distorted` angle `(alpha_distorted)` behind the lens, where the objects are projected onto the sensor image chip. The relationship between the angles is shown in the following illustration:



Note

The principal ray is the main view direction of the camera through the center of the lens. It provides the basis for measuring the angles in the scene and the radius behind the lens.

MotionDesk and the SensorSim application apply the lens distortions specified by the angles/radius in the look-up table.

For information on lens distortions, how to load lens correction profiles, and specify lens distortion effects manually, refer to Basics on Lens Distortion Effects on page 37.

CSV file format

Each row in the CSV file must contain two values separated by a semicolon as shown.

```
<Alpha undistorted value>;<Alpha_distorted value>
```

Units The values use the following units in each of the two columns.

There are two possible units that can be used to define the undistorted angle and the distorted angle.

Alpha

- `Undistorted_Angle_Radians`
- `Undistorted_Normalized_Radius`

```
= tan (Undistorted_Angle_Radians)
```

Alpha_distorted

- `Distorted_Normalized_Radius`

```
= tan(alpha_distorted)
```

- `Distorted_Radius_Pixel`: directly by the radius in pixels.

Note

Using the normalized distorted radius is recommended over using the radius directly in pixels because, for example, changes to the resolution can affect the image on the sensor image chip.

Maximum distortion radius The pixels in the image beyond the maximum distance from the center of the image that is defined in the look-up table are shown in black.

Example In the following example, the `Undistorted_Normalized_Radius` and the `Distorted_Normalized_Radius` are used:

```
Undistorted_Normalized_Radius;Distorted_Normalized_Radius
0.03;0.1
0.07;0.2
0.1;0.3
0.2;0.4
0.3;0.5
0.4;0.6
0.5;0.7
0.6;0.8
```

Tip

If the distorted radius in mm is known, you can use the following to calculate the normalized distorted radius.

```
distorted_normalized_radius = distorted_radius_mm /
focal_length_mm
```

To convert between distorted_normalized_radius and distorted_radius_pixel you can use the following formulas:

1. The diagonal of the sensor image chip in mm is as follows:
   - `diag_mm = DIAGONAL_35mm / crop_factor`

   where the following is the diagonal of a 35mm reference film format:
   - `DIAGONAL_35mm = sqrt (36.0 * 36.0 + 24.0 * 24.0),`
2. The focal length in pixels can be calculated with the following:
   - `diag_mm / focal_length_mm = diag_pixel /focal_length_pixel`
3. To convert distorted_normalized_radius to distorted_radius_pixel and vice versa, you can use the following formula:
   - `distorted_normalized_radius = distorted_radius_pixel / focal_length_pixel`

CSV file format validation If the CSV file is invalid, a warning is displayed in the Messages pane when the look-up table is selected in the MotionDesk properties pane.

For example, an error is displayed in the following conditions:

- The structure is incorrect, for example, the distorted and undistorted values are not included in a single row separated by a semicolon.
- One angle or radius is zero or negative.
- The values in the table do not rise uniformly.

Practical example

In camera specifications, it is common to specify the following:

```
distorted_normalized_radius = r * (1+D%)
```

For example, for an alpha value of 45 degrees and a distortion of `D = -20%`, the following applies:

```
r = tan (45 °) = 1
```

and

```
distorted_normalized_radius = (1-0.2) * r = 0.8
```

Method

To select a lens distortion look-up table

1. In the Scene Navigator, select Sensors - Camera Sensor or Fish-Eye Sensor.
2. In the properties pane, select Lens distortion - Look-up table in the Lens configuration category.

3 In Look-up table path, search for the CSV file that contains the lens distortions.

4 Start the simulation.

The sensor composition window displays the simulation with the lens distortions effects that you specified in the look-up table.

Note

The distortions are not displayed in the MotionDesk 3-D View.

Result

You selected a lens distortion look-up table in the MotionDesk camera or fish-eye sensor properties pane.

Related topics

Basics

Basics on Lens Distortion Effects..... 37

HowTos

How to Load an Adobe Lens Correction Profile..... 44
How to Manually Specify Adobe Lens Distortions..... 46

References

Camera and Fish-Eye Sensor Lens Configuration Properties..... 137

How to Load an Adobe Lens Correction Profile

Objective

You can load an Adobe lens correction profile from an Adobe file. The application reads the file that can adjust the lens field of view and add distortions coefficients.

Method

To load an Adobe lens correction profile from file

1 In the Lens Configuration category, select Adobe in the Lens distortion list.

2 Click the Browse button of the Load Lens correction profile information property and select a lens correction profile (LCP) file.

MotionDesk loads the file that contains a range of lens settings and effects for correcting lens distortions.

Tip

Lens correction profile

Refer to the documentation of the lens or ask the manufacturer of the lens or camera for a lens correction profile LCP file.

You can also use the *Adobe Lens Profile Creator Tool* to manually calibrate or download lens profiles in an LCP file for use with MotionDesk and sensor simulation.

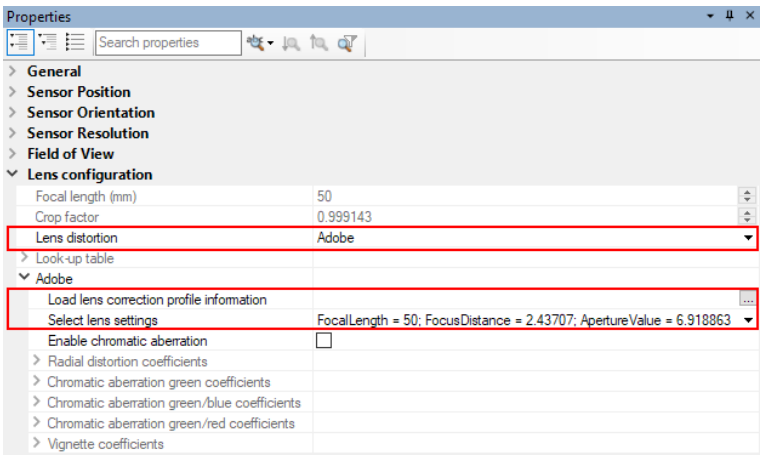
3 In Select lens settings, select a specific lens setting from the loaded lens correction profile (LCP) file.

MotionDesk applies the selected lens setting. In the following example, the focal length, crop factor, and the field of view angles change.

The lens distortion coefficient properties may also change, for example, the Vignette Coefficients

Note

The focal length, crop factor, vignetting, chromatic aberration, and radial distortion coefficients are disabled after you select a lens correction profile setting.



4 You can enable the chromatic aberration coefficients for the profile if required. Select the checkbox.

5 Right-click Sensors in the Scene Navigator and select Open/close composition window.

You can view the sensor image with the changes applied by the lens profile.

Result

The composition window displays the image for the camera sensor with lens profile changes and distortion corrections that you loaded from an LCP file.

Related topics

Basics

Basics of the MotionDesk Camera and Fish-Eye Sensors..... 22

References

Camera and Fish-Eye Sensor Properties..... 132

How to Manually Specify Adobe Lens Distortions

Objective

In MotionDesk, you can manually specify Adobe lens distortion corrections in the sensor properties pane.

Note

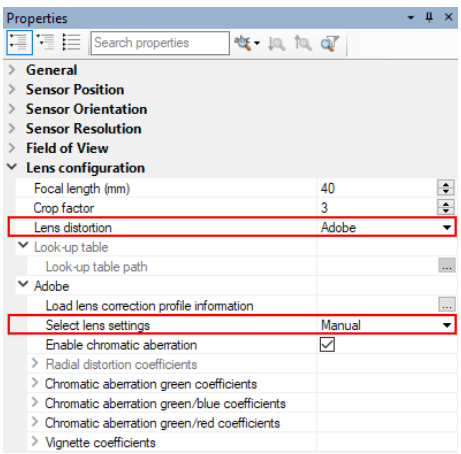
Distortion coefficient parameters
Refer to the documentation of the lens or ask the lens manufacturer for the parameter values to correct specific distortions.

Method

To specify lens distortions

1 In the Lens Configuration category, select Adobe in the Lens distortion list.

2 In Select lens settings, select Manual.



Tip

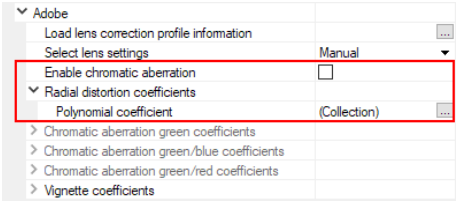
You can also load a lens correction profile in a lens correction profile LCP file for use with MotionDesk and sensor simulation. Refer to How to Load an Adobe Lens Correction Profile on page 44.

3 You can specify the lens distortions as follows as you require:

- You can clear **Enable chromatic aberration** and manually specify the **Radial distortion coefficients** in the polynomial configuration dialog.

  For more information, refer to How to Specify Polynomial Configurations for Adobe Lens Radial Distortions on page 51.

  The chromatic aberration coefficient categories are disabled.



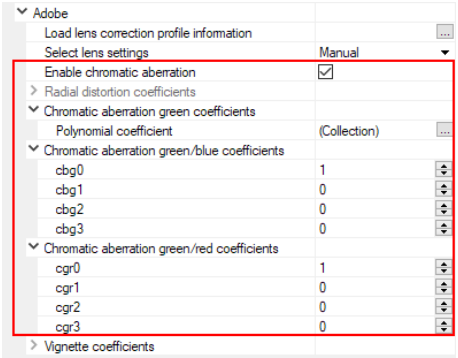
- You can select **Enable chromatic aberration** and specify the **Chromatic aberration green coefficients** in the polynomial configuration dialog.

  The main aberration distortion is determined by the **green coefficient**. You can then specify the deviation from the main distortion in the following coefficient categories.

  - **Chromatic aberration green/red coefficients:** cgr_0, cgr_1, cgr_2, cgr_3
  - **Chromatic aberration green/blue coefficients:** cgb_0, cgb_1, cgb_2, cgb_3

Note

The **radial distortion** coefficients are disabled because the chromatic aberration green channel overwrites them.



- You can specify the **Vignette** distortions in the following coefficients.
  - **Vignette coefficients:** v_1, v_2, v_3

4 Start the simulation to visualize the lens distortion effects in the **composition window**.

Result

The composition window displays the image for the camera sensor with lens distortions that you manually specified.

Related topics

Basics

Basics on Lens Distortion Effects..... 37
Working with Adobe Lens Radial Distortions..... 48

HowTos

How to Load an Adobe Lens Correction Profile..... 44
How to Specify Polynomial Configurations for Adobe Lens Radial Distortions..... 51

References

Camera and Fish-Eye Sensor Lens Configuration Properties..... 137

Working with Adobe Lens Radial Distortions

Introduction

In the MotionDesk camera and fish-eye sensor properties, you can configure Adobe lens radial distortions in a polynomial coefficient dialog. The SensorSim application renders the distortions based on these settings.

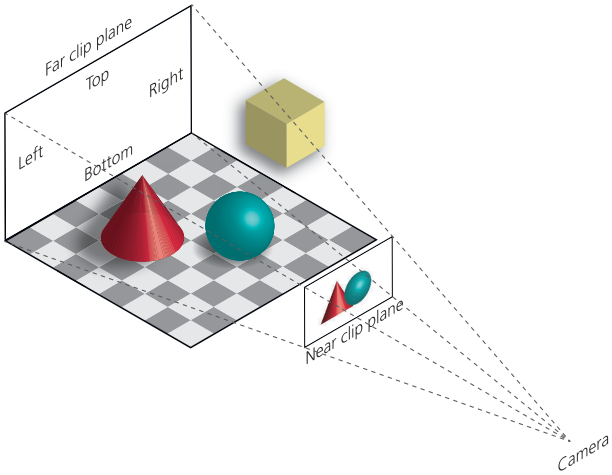
Radial distortions

Radial lens distortion is an image distortion where the straight lines of an object appear to be curved. Radial distortions can have barrel or pincushion image effects.

For more information on radial distortion, refer to Basics on Lens Distortion Effects on page 37.

MotionDesk displays an undistorted image in the observer view in the **3-D View** and the SensorSim application renders the sensor image data with the radial distortions in the sensor composition window.

As shown in the following diagram, where no distortion is applied, the near clip plane is rendered to the composite window. The yellow cube is outside the field of view frustum of the camera lens, although it is within the far clip plane.

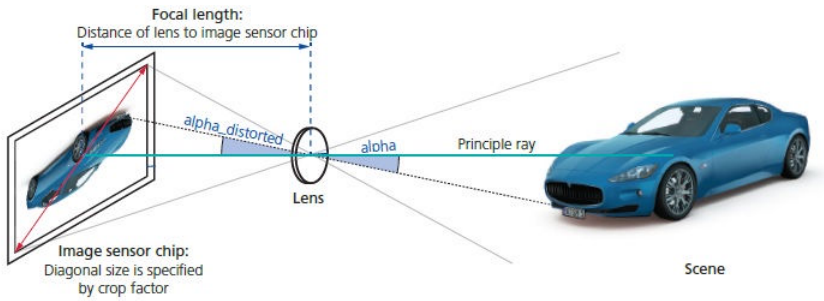


In a simple example, the difference between a distorted and undistorted image is the distance of specific pixels in the image to the image center. If two pixels in an undistorted image have the same radius to the center of the image, the same applies in the distorted image.

Where radial distortion is applied for a camera or fish-eye sensor, the relationship between the angle `alpha`, from the lens to the scene objects, and the angle `alpha_distorted` behind the lens to the image sensor chip is relevant. This relationship can be defined in a polynomial dialog.

The angles are shown in the following diagram.

The principle ray meets exactly the center of the sensor image chip.



Radial distortion formula

The formula for radial distortion are as follows.

- Camera sensor:

```
radius_distorted_normalized = polynomial(r)
```

- Fish-eye sensor:

```
radius_distorted_normalized = polynomial(alpha)
```

Where:

- `radius_distorted_normalized = tan(alpha_distorted)`
- `r = tan(alpha)`

Note

The calculations for radial distortion are based on the *Geometric Distortion Model for Rectilinear Lenses* or the *Geometric Distortion Model for Fish-eye Lenses*, specified in the document *Adobe Camera Model Version 1.0 by Adobe Systems*.

You can also load lens distortions using a look-up file. Refer to How to Select a Lens Distortion Look-Up Table on page 41.

Related topics

Basics

Basics on Lens Distortion Effects 37

HowTos

How to Manually Specify Adobe Lens Distortions 46
How to Select a Lens Distortion Look-Up Table 41

References

Camera and Fish-Eye Sensor Lens Configuration Properties 137

How to Specify Polynomial Configurations for Adobe Lens Radial Distortions

Introduction

In the MotionDesk camera and fish-eye sensor properties, you can specify the polynomial configurations for the radial distortions. The SensorSim application renders the distortions based on the settings.

Polynomials

You can specify the polynomials for the camera and fish-eye sensor radial distortions according to the **Adobe lens distortion model**. This model provides a standard polynomial configuration for radial distortions. The model allows polynomials with a maximum exponent order of seven.

The following example shows a formula for a camera sensor:

$p(r) = r + k_1\, r\hat{}3 \; + \; k_2 r\hat{}5 \; + k_3\hat{}{*}r\hat{}7$

In the MotionDesk properties for camera and fish-eye sensors, you can also specify polynomial coefficients with higher exponents than the Adobe specification, for example:

$p(r) = r + 2r\hat{}9.$

When you apply higher order polynomial coefficients for radial distortion, the effects of the distortion are applied at increased angles, for example, towards the border of the image.

For more information on radial distortions , refer to Working with Adobe Lens Radial Distortions on page 48.

Note

For more information on the Adobe lens distortions coefficients, refer to the Adobe Camera Model Version 1.0 by Adobe Systems.

Method

To specify polynomial configurations for camera and fish-eye sensor radial distortions

1. In MotionDesk, select a camera or fish-eye sensor sensor in the **Scene Navigator**.
2. In the Properties pane, select **Lens distortion** in the lens configuration category.
3. Select **Adobe** from the list.

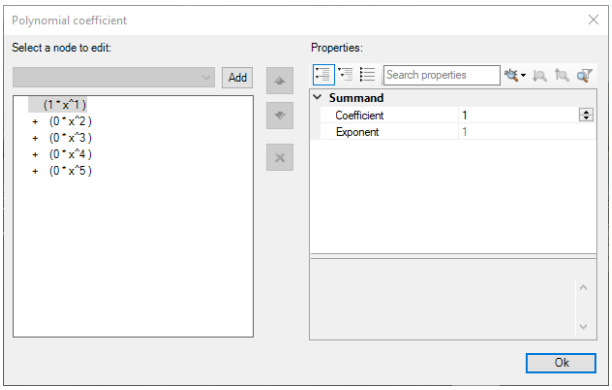
   The Adobe property is now selectable.
4. Expand the **Adobe** property.

5 Expand the Radial Distortions Coefficient category and select the Polynomial coefficient button.

Note

Radial Distortions Coefficient is gray and cannot be selected if Enable chromatic aberration is selected.

The Polynomial coefficient dialog opens.



6 Add a polynomial coefficient Node with the next exponent value in the sequence or select one of the existing five default values.

Note

The node variable x for the camera and fish-eye sensors represents the following:

- Camera sensor: x represents `r`
- Fish-eye sensor: x represents `alpha`

7 Select the up or down arrow in the Summand category on the right of the pane to increase or decrease the Coefficient.

The x value is raised by the power of the Exponent.

Note

Exponent is a display field. The exponent is predefined when you add the node.

For more information on all the properties to which you can apply polynomial configurations for camera and fish-eye sensor radial distortions, refer to Camera and Fish-Eye Sensor Lens Configuration Properties on page 137.

8 Start the simulation or play the motion data in the Motion Player.

The animation displays the scene in the sensor composition window with the polynomial configurations for radial distortions applied to the image.

Result

You specified polynomial configurations for camera and fish-eye sensor radial distortions.

Related topics

Basics

Basics on Lens Distortion Effects..... 37

References

Camera and Fish-Eye Sensor Lens Configuration Properties..... 137

Configuration of Camera and Fish-Eye Output Settings

Introduction

You can use MotionDesk to configure camera and fish-eye sensor output settings for sensor simulation.

Where to go from here

Information in this section

Basics on the Camera and Fish-Eye Output Settings.....54
In MotionDesk, you can specify the camera and fish-eye output settings in the sensor properties pane for sensor simulation.

How to Configure Exposure Image Processing.....57
In the camera and fish-eye sensor properties, you can adjust the image luminance rendered by the SensorSim application by configuring the lens light exposure. This increases or decreases the brightness of the image data to insert into the image sensor chip in sensor simulation.

How to Apply Gamma Correction Image Processing.....59
In the camera and fish-eye sensor properties, you can enable gamma correction (encoding) on the image data that is to be displayed on a screen in the sensor composition window for over-the-air simulations.

How to Display a Raw Data Image for a Camera or Fish-Eye Sensor.....61
In MotionDesk, you can display a raw data image, for example, a Bayer pattern, for a camera or fish-eye sensor for sensor simulation.

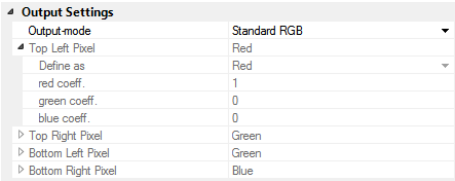
Basics on the Camera and Fish-Eye Output Settings

Introduction

In MotionDesk, you can specify the camera and fish-eye output settings in the sensor properties pane for sensor simulation.

Overview

You can set the output settings for the lens in the camera and fish-eye sensor properties pane.



Output Settings	
Output-mode	Standard RGB
Top Left Pixel	Red
Define as	Red
red coeff.	1
green coeff.	0
blue coeff.	0
Top Right Pixel	Green
Bottom Left Pixel	Green
Bottom Right Pixel	Blue

For more information, refer to How to Display a Raw Data Image for a Camera or Fish-Eye Sensor on page 61.

Output settings

It is possible to display the raw data of single-chip sensors. Instead of the regular output of the camera images, you can display 2 × 2 pattern in the high dynamic range (12-bit or 24-bit length) for the camera sensor. You can specify the intensity of each pixel of the patterns. This means you can specify different kinds of patterns, for example, the Bayer pattern or pattern with a CYGM filter.

Intensity calculation The intensity I_{out} is calculated according the following formula:

$$I_{\text{out}} = \left(\text{cr}\, R^{(1/\gamma)} + \text{cg}\, G^{(1/\gamma)} + \text{cb}\, B^{(1/\gamma)}\right)^{\gamma}$$

Where

R, G, B are the values for red, green, and blue of the regular output as unsigned normalized integers in the range 0 … 1.

$\text{cr}, \text{cg}, \text{cb}$ are the coefficients that are used for the pixels of the pattern displayed in the composition window. The coefficients are specified via properties. Refer to Camera and Fish-Eye Sensor Properties on page 132.

γ is the gamma value. The value of γ is 2.2 in MotionDesk.

Intensity coding The calculated intensity is coded in the RGB value of a pixel in the composition. MotionDesk provides two modes of coding: a 24-bit pattern mode and a 12-bit pattern packed mode.

In the *24-bit pattern* mode, the intensity is coded as a 24-bit unsigned normalized integer. The 8 most significant bits are saved in the red value of the composition pixel, the next 8 bits are saved in the green value of the composition pixel, and the last 8 bits are saved in the blue value of the composition pixel. Refer to the following table:

Intensity in 24-bit pattern	c_{23}	…	c_{16}	c_{15}	…	c_8	c_7	…	c_0
Pixel in composition	r_7	…	r_0	g_7	…	g_0	b_7	…	b_0

In the *12-bit pattern packed* mode, the intensity of two neighboring sensor pixels is coded in one RGB value of a pixel (3 × 8 bits) in the composition. The intensity of the left sensor pixel ($Intensity_c$) can be calculated according the following formula:

$Intensity_c = ((R << 8) + (G >> 4)) / 4095$

The intensity of the right sensor pixel ($Intensity_d$) can be calculated according the following formula:

$Intensity_d = ((G \,\&\, 15) << 8 + B) / 4095$

Where

R, G, B are the values for red, green, and blue of the pixel in the composition.

& is a bitwise AND operation.

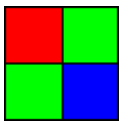
<< is a shift operation.

The following table shows the assignment for the 12-bit pattern packed mode.

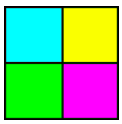
Intensity in 12-bit pattern packed	c_{11}	…	c_4	c_3	…	c_0	d_{11}	…	d_8	d_7	…	d_0

Pixel in composition	r_7	…	r_0	g_7	…	g_4	g_3	…	g_0	b_7	…	b_0

Example: Bayer pattern Using the 2 × 2 pattern, you can implement a Bayer pattern for the pixels. To specify the coefficients for the output settings, you can use predefined values for red, green, and blue.

Bayer Pattern	Coefficients	
	Red cr = 1.0 cg = 0.0 cb = 0.0	Green cr = 0.0 cg = 1.0 cb = 0.0
	Green cr = 0.0 cg = 1.0 cb = 0.0	Blue cr = 0.0 cg = 0.0 cb = 1.0

Example: CYGM filter Using the 2 × 2 pattern, you can implement a CYGM filter for the pixels. To specify the coefficients for the output settings, you can use custom coefficients.

CYGM Filter	Coefficients	
	cr = 0.0 cg = 0.5 cb = 0.5	cr = 0.5 cg = 0.5 cb = 0.0
	cr = 0.0 cg = 1.0 cb = 0.0	cr = 0.5 cg = 0.0 cb = 0.5

Note

If you use the composition for raw data, you must not use an anti-aliasing mode of the graphics card. An anti-aliasing of the graphics card could modify the information of the composition and corrupt it.

What's next

You will learn how to display a raw data image for a sensor. Refer to How to Display a Raw Data Image for a Camera or Fish-Eye Sensor on page 61.

Related topics

Basics

Basics on Lens Distortion Effects..... 37

HowTos

How to Display a Raw Data Image for a Camera or Fish-Eye Sensor..... 61

References

Camera and Fish-Eye Sensor Properties..... 132

How to Configure Exposure Image Processing

Introduction

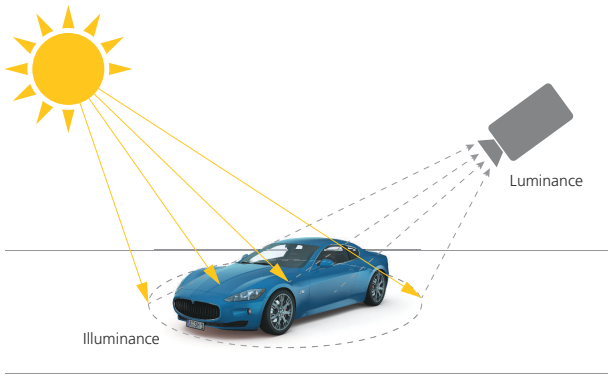
In the camera and fish-eye sensor properties, you can adjust the image luminance rendered by the SensorSim application by configuring the lens light exposure. This increases or decreases the brightness of the image data to insert into the image sensor chip in sensor simulation.

Overview of luminance

Luminance is the measure of light intensity, or brightness of a light source that is reflected off objects in a scene, for example, the sun. `Illuminance` is the amount of light produced from the input light source.

An image displays all objects in the scene with varying amounts of luminance. Too much luminance leads to glare and reduced visibility of the scene to the viewer or the sensor.

The following diagram displays a basic overview of luminance and illuminance.



Exposure

Exposure is a physical setting of a lens that controls the amount of light exposure that is allowed through the lens onto the image sensor of a camera.

You can adjust the amount of light exposure for the rendering of the SensorSim application for camera or fish-eye sensor image data.

When you increase the exposure for the sensor, the image brightness that is rendered by the SensorSim application increases.

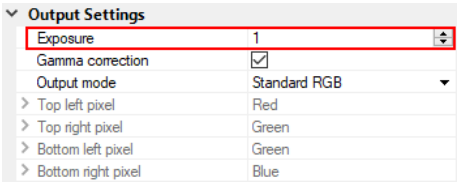
This is helpful in darker scenes where the detail in the scene is not clear for the sensor. You can also reduce the exposure if the image of the scene is too bright.

Method

To configure exposure

1 In MotionDesk, select a camera sensor or a fish-eye sensor in the Scene Navigator.

2 Click the up arrow button in Output Settings - Exposure to increase the exposure of the 3-D View to 2. The default exposure is 1.



3 Click the down arrow button in Output Settings - Exposure to reduce the exposure of the 3-D View to 0.5.

4 Start the simulation or play the motion data in the Motion Player.

The animation displays the scene in the sensor composition window for the camera or fish-eye sensor with the exposure settings applied.

The following images show the scene in the sensor composition window for a camera sensor with the exposure values of 0.5, 1, and 2.

Exposure = 0.5	Exposure = 1	Exposure = 2

Result

You selected the exposure settings for a camera sensor or a fish-eye sensor and viewed the results in the sensor composition window.

Related topics

Basics

Basics on the Camera and Fish-Eye Output Settings..... 54

HowTos

How to Apply Gamma Correction Image Processing..... 59

References

Camera and Fish-Eye Sensor Properties..... 132

How to Apply Gamma Correction Image Processing

Introduction

In the camera and fish-eye sensor properties, you can enable gamma correction (encoding) on the image data that is to be displayed on a screen in the sensor composition window for over-the-air simulations.

Gamma correction

A camera or fish-eye sensor records images with specific uniform levels of luminance. The image data can then be used for raw data simulations where data is inserted into the sensor processing units or directly into the ECU.

The human eye perceives the brightness nonlinearly. For example, twice the brightness is seen as only a fraction brighter.

Gamma correction (encoding) compensates for how a standard screen displays the luminance levels of an image. A gamma-corrected image is brighter and is displayed more closely to how the human eye would a scene. This can also ensure that all objects in the scene are visible in the image to the user and to the sensors in over-the-air simulations.

The SensorSim application instance applies gamma correction to an image by compressing the dynamic range of light and colors before on-screen display.

Note

For raw data simulations, gamma correction must not be selected. Gamma correction is not included in raw data file formats and is unlikely to be required for raw data simulations.
It can be applied to the raw image data for on-screen formats, for example, a JPG or for the display of parking camera images.

Gamma correction formula The standard gamma value γ used for a computer display screen is 2.2. This value approximately matches the power law sensitivity of human vision.

The formula for gamma correction can be defined as follows:

$$V_{out} = V_{in}^{1/\gamma}$$

where:

- V_{in}: is the actual input luminance to the power of gamma. Equals V_{out}.
- V_{out}: is the output luminance.
- γ: 2.2 is used for a standard monitor.

Method

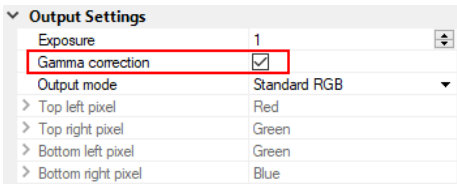
To select and clear gamma correction

1 In MotionDesk, select a camera sensor or a fish-eye sensor in the Scene Navigator.

2 For raw data simulations, in the Properties pane, clear Output Settings - Gamma correction.

Note

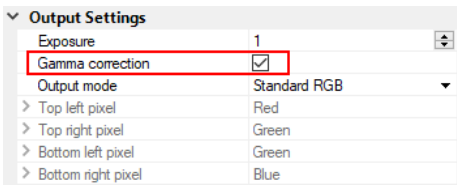
Gamma correction is selected by default for new camera and fish-eye sensors.



3 Start the simulation or play the motion data in the Motion Player.

The animation displays the scene in the sensor composition window for the camera or fish-eye sensor without gamma correction.

4 In the Properties pane, select Output Settings - Gamma correction again.



5 Start the simulation or motion data in the Motion Player.

The animation displays the scene in the sensor composition window for the camera or fish-eye sensor with gamma correction.

The simulation in the sensor composition window appears as follows:

Gamma Correction Selected

Result

You selected and cleared gamma correction for a camera sensor or a fish-eye sensor and viewed the results in the sensor composition window.

Related topics

Basics

Basics on the Camera and Fish-Eye Output Settings..... 54

HowTos

How to Configure Exposure Image Processing..... 57

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Camera and Fish-Eye Sensor Properties..... 132

How to Display a Raw Data Image for a Camera or Fish-Eye Sensor

Objective

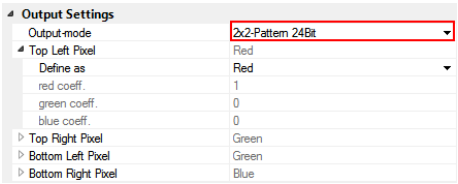
In MotionDesk, you can display a raw data image, for example, a Bayer pattern, for a camera or fish-eye sensor for sensor simulation.

Method

To display a raw data image for a camera sensor

1 In the Scene Navigator, select the camera or fish-eye sensor.
The Properties pane displays the properties of the camera or fish-eye sensor.

2 In Output mode, select `2×2-Pattern 24Bit` or `2×2-Pattern 12Bit packed`.



3 Specify the settings for each pixel of the 2 × 2 pattern:
- In Define as select a predefined set of coefficients or `Custom coefficients`.
- If you selected `Custom coefficients`, specify the values of the coefficients.

Note

Ensure that anti-aliasing of the graphics card is disabled.
If anti-aliasing of the graphics card is enabled, the information for the composition is corrupted.

4 Start the animation to visualize the lens distortion effects. You can see the raw data image for the camera or fish-eye sensor in the composition window.

Result

The composition window displays the raw data image for the camera or fish-eye sensor.

Related topics

Basics

Basics of the MotionDesk Camera and Fish-Eye Sensors..... 22
Basics on the Camera and Fish-Eye Output Settings..... 54

References

Camera and Fish-Eye Sensor Properties..... 132

Configuration of Camera and Fish-Eye Postprocessing

Introduction

You can use MotionDesk to configure camera and fish-eye sensor postprocessing for sensor simulation.

Where to go from here

Information in this section

Postprocessing the Images of Camera and Fish-Eye Sensors.....63
You can manipulate the images processed for the camera and fish-eye sensors by implementing a postprocessing routine, which you code in a dynamic link library.

How to Enable Postprocessing for a Camera and Fish-Eye Sensor.....65
If you have coded a library for postprocessing, you can enable it for a camera or fish-eye sensor.

Example of Postprocessing the Images for a Camera and Fish-Eye Sensor.....66
Two ready-to-use examples are installed with MotionDesk that demonstrates postprocessing.

Working with Material IDs in Postprocessing Camera and Fish-Eye Output.....68
You can use a postprocessing library to access the material IDs of the 3-D objects in the MotionDesk scene for the camera and fish-eye sensor data output.

Postprocessing the Images of Camera and Fish-Eye Sensors

Introduction

You can manipulate the images processed for the camera and fish-eye sensors by implementing a postprocessing routine, which you code in a dynamic link library.

Basics of postprocessing

When you use postprocessing, you can manipulate the images for the camera and fish-eye sensors for sensor simulation. This can be used, for example, to insert pixel errors or simulate parts that are too bright or dark.

Postprocessing is done after MotionDesk has rendered the image for the camera and fish-eye sensor, including the lens distortion correction effects that have been set in the properties. The output settings are then applied after postprocessing before the output is written to the composition window or to shared memory, if selected.

User requirements

To implement postprocessing, you must code a dynamic link library (DLL). Knowledge of C++ programming is therefore required.

Files

The files required for postprocessing are installed in the following folder:

`<MotionDesk_InstallationPath>`

This folder has two subfolders:

- `bin`: The folder contains two ready-to-use examples.
- `Sources`: The folder contains files for using the camera postprocessing interface and the source code of the examples.

Using the camera postprocessing interface

The `CameraPostProcessing interface` has two header files that you must use in the implementation of the postprocessing library.

CameraPostProcessor_Interface.h The header file defines the class and methods that are called by MotionDesk. Comments in the file header give you more information on how MotionDesk calls the methods.

TypeDefinitions.h The header file defines the data types that are used for the methods of the interface. Comments in the header file describes the data type in details.

dSPACE provides two examples that demonstrate the use of the interface. You can use the example as the basis to create your own implementation. Refer to Example of Postprocessing the Images for a Camera and Fish-Eye Sensor on page 66.

Note

NVIDIA CUDA 10.2 graphics card support

To use the postprocessing demo example delivered with MotionDesk 4.8 with sensor simulation, you must have an NVIDIA graphics card that supports the NVIDIA CUDA Toolkit 10.2.

You can also compile the demo example with a lower NVIDIA CUDA Toolkit version or write your own postprocessing routine with a suitable CUDA toolkit version.

For more information on hardware requirements, refer to Additional Requirements for Sensor Simulation (Installing dSPACE Software 🕮).

Library path

To use a postprocessing library, you must copy the file to the `Plugins` folder in the custom objects library folder. The folder of the custom objects library is located outside any dSPACE installation. This protects the files from being accidentally overwritten when the dSPACE software installation is modified. It is recommended to use a separate folder for each library. Refer to the following folder structure:

```
<Folder of the custom object library>/Plugins/<library>
```

Note

You should not run a simulation using the motion data or MDF files when debugging the postprocessing library. The connection to the simulator can be terminated by a timeout.

Related topics

Basics

Basics on the Camera and Fish-Eye Output Settings..... 54

HowTos

How to Enable Postprocessing for a Camera and Fish-Eye Sensor..... 65

Examples

Example of Postprocessing the Images for a Camera and Fish-Eye Sensor..... 66

How to Enable Postprocessing for a Camera and Fish-Eye Sensor

Objective

If you have coded a library for postprocessing, you can enable it for a camera or fish-eye sensor.

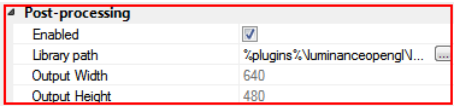
Preconditions

A library implemented for postprocessing must exist in the `<Folder of custom object library>/Plugins/<library>` folder. Refer to Postprocessing the Images of Camera and Fish-Eye Sensors on page 63.

Method

To enable postprocessing for a camera sensor

1. In the Scene Navigator of MotionDesk, select the camera or fish-eye sensor for which you want to perform postprocessing.
2. In the Properties pane, click the Browse button of the Library path in the Post-processing category.
3. Select the DLL library for the postprocessing routine you want to implement.
4. Select Enabled of the Post-processing category.



Note

To change the output height and width, you must change the values in the Sensor Resolution category.

Result

Postprocessing is enabled. When the scene is animated, the composition window displays the modified image, or the raw data is output to the sensor simulation hardware.

Related topics

Basics

Postprocessing the Images of Camera and Fish-Eye Sensors..... 63

Examples

Example of Postprocessing the Images for a Camera and Fish-Eye Sensor..... 66

Example of Postprocessing the Images for a Camera and Fish-Eye Sensor

Introduction

Two ready-to-use examples are installed with MotionDesk that demonstrates postprocessing.

Description

The following two demos are installed.

LuminanceOpenGL This is a short and simple demo that explains the basics of the interface. In this example, the luminance of the whole image is changed in every frame by a different factor.

Building this demo requires that OpenGL is installed and can be found by CMake. Normally, OpenGL is installed with Visual studio. CMake searches the OpenGL header and lib file and then creates a solution for Visual.

LuminanceTextureCuda This demo shows how to create a Cuda based postprocessing library. An RGB luminance image is loaded as a resource for the postprocessing and each pixel intensity in each color channel is multiplied by the corresponding intensity read from this luminance image. The `vignette_and_pixelerrors.data` image is supposed to have size 1920 × 1080 and contains 8-bit RGB intensities. It can be opened and changed, for example, using GIMP. If the camera resolution uses another resolution, the image is stretched accordingly.

Building this demo requires that Cuda is installed and can be found by the compiler.

Using the demos

The demos are ready-to-use. The binaries are installed in `<MotionDesk_InstallationPath>\Demos\MotionDesk\SensorSimulationDemos\CameraPostprocessing\bin\LuminanceOpenGL` or `\LuminanceTextureCuda`. To use a demo, you must copy its files to the `<Folder of the custom object library>\Plugins` folder. For details, refer to How to Enable Postprocessing for a Camera and Fish-Eye Sensor on page 65.

Note

NVIDIA CUDA 10.2 graphics card support

To use the postprocessing demo example delivered with MotionDesk 4.8 with sensor simulation, you must have an NVIDIA graphics card that supports the NVIDIA CUDA Toolkit 10.2.

You can also compile the demo example with a lower NVIDIA CUDA Toolkit version or write your own postprocessing routine with a suitable CUDA toolkit version.

For more information on hardware requirements, refer to Additional Requirements for Sensor Simulation (Installing dSPACE Software 🕮).

Modifying and building the demos

Based on the installed demos, you can build your own library.

Preconditions To build a library, a compiler is required. The examples are prepared for CMake 3.11 and higher. You can also use another compiler but then you must adapt a script.

To modify the examples, perform the following steps:

1. Copy the complete `\Demos\<MotionDesk_InstallationPath>\MotionDesk\SensorSimulationDemos\CameraPostprocessing` folder to a folder where you have read and write permissions.
2. If `cmake.exe` cannot be used as a command, copy it to a folder relative to the `examples` folder: `\..\Import\CMake\bin\cmake.exe`
3. Open `\examples\LuminanceChangeOpenGL` or `\LuminanceTextureCuda` folder.

   In both folders is a `CreateSolution.bat` file that must be adapted to your settings.
4. Edit the `CreateSolution.bat` file. Consider the following points:
   - Specify the installation folder of the library. Refer to Library path on page 64
   - If you use another compiler than `cmake.exe`, you must add the call to your compiler. You can also build a solution using the `CMakeLists.txt` and `cmake-gui`, for example.
5. Adapt the source code of the library according to your needs.
6. Execute the `CreateSolution.bat` script to start the build process.

   After building the library, it is copied to the specified folder.

7. Enable postprocessing and select the library. Refer to How to Enable Postprocessing for a Camera and Fish-Eye Sensor on page 65.

Related topics

Basics

Postprocessing the Images of Camera and Fish-Eye Sensors..... 63

HowTos

How to Change the Location of the Custom Objects Library (MotionDesk Custom Object Library Management 🕮)
How to Enable Postprocessing for a Camera and Fish-Eye Sensor..... 65

Working with Material IDs in Postprocessing Camera and Fish-Eye Output

Introduction

You can use a postprocessing library to access the material IDs of the 3-D objects in the MotionDesk scene for the camera and fish-eye sensor data output.

Overview

The camera and fish-eye sensors detect an object with a material ID that matches material IDs in the `materialmapping.XML`. The material ID is encoded into the corresponding pixel of the sensor data output.

Postprocessing of material ID output

The postprocessing API for the camera and fish-eye sensors allows the postprocessing library to access the material IDs of the detected objects in the scene in addition to the regular camera or fish-eye sensor data.

If postprocessing is enabled for a sensor in the MotionDesk properties and a postprocessing library (DLL) has been selected, MotionDesk calls a method for each frame of the scene to apply the postprocessing of the library.

The postprocessing library can be written to decide if the material ID output is required before the postprocessing of the library is applied.

If a detected object is transparent, the material ID preview color of the first material detected is shown in the output. For example, a glass windshield is shown instead of the steering wheel behind window.

What's next

You will learn about radial lens distortions in Working with Adobe Lens Radial Distortions on page 48.

Related topics

Basics

Basics on Material Management (Sensor Simulation Manual 🕮)

HowTos

How to Display the Material ID Preview in MotionDesk (MotionDesk Scene Animation 🕮)

References

3-D View Properties (MotionDesk Scene Animation 🕮)

Configuration of Laser Sensors

Introduction

You can use MotionDesk to configure laser sensors for sensor simulation.

Where to go from here

Information in this section

Basics of the MotionDesk Laser Sensors.....70
In MotionDesk, you can insert laser sensors into the scene in the 3-D View and provide an image or raw data for sensor simulation. You can control the sensor representation, field of view, and a range of outputs in the properties.

How to Insert a Laser Sensor.....73
You can insert a laser sensor into the MotionDesk scene in the 3-D View.

How to Change the Basic Laser Sensor Properties.....75
You can configure the 3-D representation of a laser sensor in the 3-D view, for example, the position, size, orientation, and frustum.

How to Change the Laser Sensor Output Mode.....78
You can change the output mode of the laser sensor. You can display this output in the composition window. The output can be copied to shared memory for raw data sensor simulation.

Basics of the MotionDesk Laser Sensors

Introduction

In MotionDesk you can insert laser sensors into the scene in the 3-D View and provide an image or raw data for sensor simulation. You can control the sensor representation, field of view, and a range of outputs in the properties.

Required license

To download scenes that contain laser sensors to the SensorSim application and use with sensor simulation, you must activate the MDD_SENSOR_LIDAR license.

In MotionDesk, you can create and configure any number of camera, fish-eye, and laser sensors using the basic MotionDesk license.

Note

Sensor license activation
If you have not activated the licenses for each sensor type that you added to the scene in the 3-D View, all sensors in the scene are deactivated. The sensors are reactivated when you install and activate the licenses.

For more information, refer to Licenses for Sensor Simulation (Sensor Simulation Overview 🕮).

Screen display for the laser sensor

The MotionDesk PC should have at least two screens:

One display can be used for the MotionDesk 3-D View and another for the laser sensor output in the composition window. You can follow the simulation form the perspective of the laser sensor.

You can select the display used for the composition window in the MotionDesk options. For more information, refer to How to Configure a MotionDesk Screen for Sensor Simulation on page 18.

Note

It is recommended that both displays have the same screen resolution and the same settings for the size of text and other items. If these settings differ, the display preview for the laser sensor can only show part of the view for the sensor.

Laser sensor overview

You can insert a laser sensor into a scene in the 3-D View and edit the display and behavior properties.

The sensor provides a laser point output view of the scene in the simulation from the perspective of the laser. You can attach the sensor to the vehicle chassis and assign motion data from the simulation to it. The scene preview can be displayed in the composition window and the data downloaded to the SensorSim application.

Sensor representation The laser sensor is displayed as a 3-D box representation in the scene in the 3-D View. You can specify the position, orientation, size and color of the laser sensor in the properties. Because the sensor is typically attached to the chassis, you can assign chassis motion data to it, so that it moves with the chassis in the animation. Its absolute position is derived from the motion data. You can specify an offset from this position in the properties.

Sensor field of view The field of view is the area that is monitored by the laser sensor. You can edit the properties to change the angle of the field of view and the near and far points of the laser sensor.

Sensor Frustum The field of view from the sensor is displayed by a frustum in the 3-D View. You can also specify the appearance of the frustum by specifying the line color.

Sensor point cloud visualization A laser sensor projects laser beams and measures the reflections to calculate the distance to a large number of points on the surfaces of objects in the environment that lie within the sensor field of view. These points form a 3-D point cloud image of the objects in the scene.

You can change the display settings of the point cloud, for example, the point size and color.

Laser sensor view

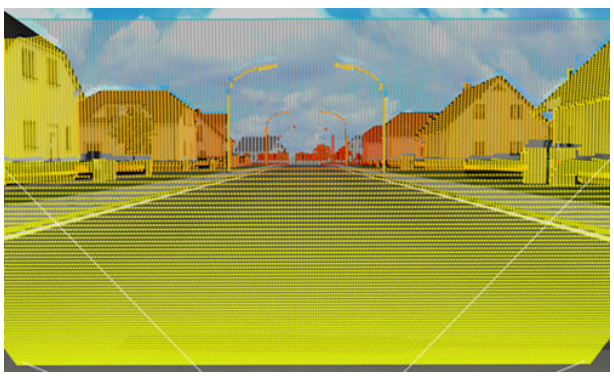
The properties of the laser sensor that you specified are shown in the 3-D View. This includes the size of the field of view, which represents the area the sensor monitors in the scene.

The composition window displays the perspective from the sensor in the simulation. The properties, for example, the output modes that you set for the laser sensor, are reflected in the output images.

View frustum The position, orientation, and field of view of the laser sensor are displayed as a frustum in the observer view in the 3-D View. The point cloud within this field of view displays the points in the virtual world where the laser beams are reflected by objects in the environment. The color of the points indicates the distance between the laser sensors and objects, see the following example of the 3-D View.

In this example, the gray points indicate the laser beams that are not reflected by objects. These are the infinity points at the end of the laser sensor range. The red points indicate reflection of far objects. The yellow points indicate reflection of near objects. Points of objects between the near and far area are colored with a mixture of yellow and red proportional to the distance to the laser sensor. You can specify the colors and dimensions of the point clouds using properties.

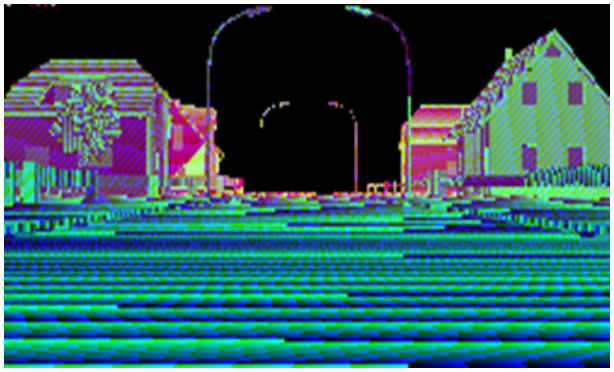
The point cloud from the driver observer view could look like this:



Composition window The field of view area that is captured by the laser sensor can be displayed in the composition window on the second display.

You can also select what information captured by the laser sensor to display. You can choose from a range of output types. For more information, refer to How to Change the Laser Sensor Output Mode on page 78.

The following illustration shows the **Depth** output of the laser sensor in the **composition window**.



Related topics

Basics

Licenses for Sensor Simulation (Sensor Simulation Overview 🕮)
Overview of Sensor Simulation (Sensor Simulation Overview 🕮)

HowTos

How to Change the Laser Sensor Output Mode..... 78
How to Configure a MotionDesk Screen for Sensor Simulation..... 18

References

Laser Sensor Properties..... 141

How to Insert a Laser Sensor

Objective

You can insert a laser sensor into the MotionDesk scene in the 3-D View.

Precondition

- A screen must be configured if you want to view the laser sensor output in the composition window. Refer to How to Configure a MotionDesk Screen for Sensor Simulation on page 18.
- The MotionDesk experiment should be ready for animation. This means, that the scene is created and the movable objects are assigned to motion data from the simulation.

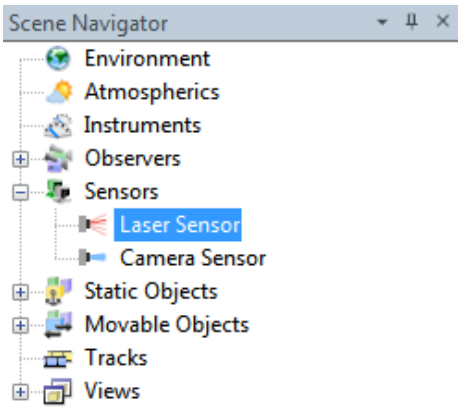
Method

To insert a laser sensor

1 In the Scene Navigator, right-click on the Sensors node and select Create Laser Sensor in the context menu.

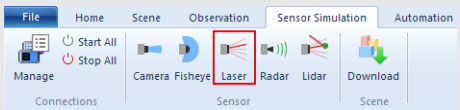
MotionDesk adds a new laser sensor. This is displayed in the tree.

The sensor is enabled by default.



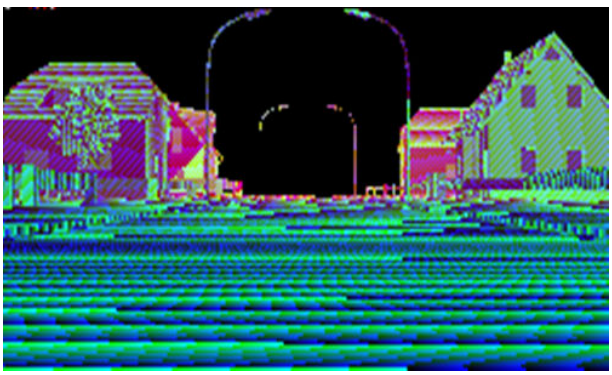
Tip

You can also select Laser on the Sensor Simulation ribbon to add a new laser sensor.



2 In the Scene Navigator, on the Sensors node, select Open/Close Composition Window.

The composition window opens. You can observe the field of view seen by the laser sensor. This is shown with the default laser output.



3 In MotionDesk, select the Open/Close Composition Window in the Sensor properties pane to close the composition window.

Result

A laser sensor is created and you have observed the initial laser field of view in the composition window.

Related topics

Basics

Basics of the MotionDesk Laser Sensors..... 70

HowTos

How to Configure a MotionDesk Screen for Sensor Simulation..... 18

References

Create Laser Sensor..... 118
Fly to Object (MotionDesk Scene Creation 🕮)
Laser Sensor Properties..... 141
Sensor Simulation Properties..... 129

How to Change the Basic Laser Sensor Properties

Objective

You can configure the 3-D representation of a laser sensor in the 3-D view, for example, the position, size, orientation, and frustum.

Precondition

A laser sensor must be added to the MotionDesk scene.

Overview

To configure the 3-D representation of a laser sensor in the scene view and the see the field of view output in the composition window, you do the following:

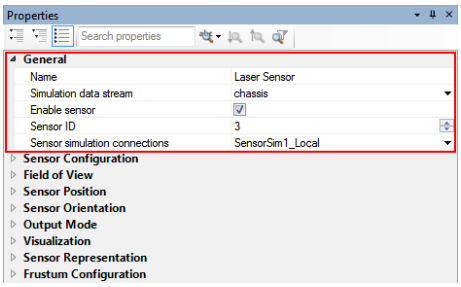
- Assign motion data to the laser sensor. Refer to Part 1.
- Change the basic laser settings and observe the laser field of view output in the composition window. Refer to Part 2.

Part 1

To assign motion data to the laser sensor

1 In the Scene Navigator, select the laser sensor.

The Properties pane displays the properties of the laser sensor.



2 In the General category, select a simulation data stream for the sensor. Normally, the sensor is moved with the chassis.

3 You must enable the sensor. Select Enable sensor in the General category.

4 Start the simulation or start the Motion Player to move the laser sensor to the start point attached to the vehicle chassis.

The composition window opens and displays the laser sensor output mode field of view moving with the motion data.

5 Stop the animation.

Part 2

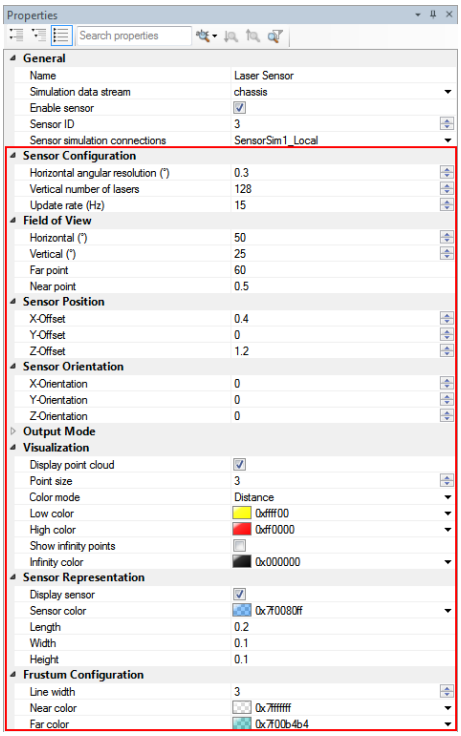
To change basic laser sensor properties

1 Select a free observer and move to the laser sensor in the scene.

Tip

When the laser sensor has the motion data of the chassis, click the 3-D object of the chassis in the Scene Navigator and select Fly to Object from the context menu. The free observer is moved to the chassis and thus also to the laser sensor. Now you can move the free observer to a more convenient position.

2 Select the Laser Sensor in the Scene Navigator tree to display the Properties pane.



You can now change the basic laser sensor settings.

When you modify these properties, MotionDesk immediately updates the MotionDesk observer view and the image in the composition window.

3 In the Sensor Configuration category, you can specify the number of vertical number of lasers and the horizontal resolution.

4 In the Field of View category, specify the properties for the field of view. For example, you can change the horizontal and vertical view range of the laser. You can also set the near and far points at which the laser sensor can detect objects.

5 In the Sensor Position category, specify the offset values. These offset values are related to the point given from the simulation data stream. You change the position of the sensor in relation to the car chassis.

6 In the Sensor Orientation category, specify angles for the orientation of the sensor in relation to the car chassis.

7 In the Visualization category, specify if you want to display the point cloud. You can also specify the point size and colors.

8 In the Sensor Representation category, you can select Display sensor to display the field of view frustum. You can also adjust the Sensor color and Sensor Size as displayed in the scene in the 3-D View.

9 In the Frustum Configuration category, you can change the frustum line width and colors that represent the field of view. The field of view is represented as a pyramid in the scene in the 3-D view.

Tip

Theses properties have no effect on the composition window field of view.
During the simulation or tests, you can clear the Display sensor property in Sensor Representation to animate the scene without the frustum. This has no effect on the sensor simulation.

10 Start the simulation to visualize the basic laser settings changes moving with the vehicle in the animation and the laser output mode in the composition window.

Result

You have changed the basic laser settings and viewed the laser sensor field of view in the MotionDesk scene. You have also viewed the selected laser output mode image in the composition window. You have also added the laser frustum and point cloud to the MotionDesk scene.

Related topics

References

Laser Sensor Properties..... 141

How to Change the Laser Sensor Output Mode

Objective

You can change the output mode of the laser sensor. You can display this output in the composition window. The output can be copied to shared memory for raw data sensor simulation.

Precondition

- A laser sensor must be added to the MotionDesk scene.
- You must assign motion data to the laser sensor and change the basic settings.

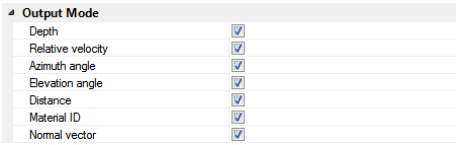
Method

To change the laser sensor output mode

1 In the Scene Navigator, click on the Sensors node and click Open/Close composition window in the Properties pane.

2 In the Scene Navigator, select the laser sensor.
The Properties pane displays the properties of the laser sensor.

3 In the **Output Mode** category, select the output modes you need for sensor simulation.



4 You must enable the laser sensor. Select **Enable sensor** in the **General** category.

5 Start the simulation and animation

The composition window opens and displays the laser sensor output modes you selected in a field of view moving with the motion data.

6 Stop the animation.

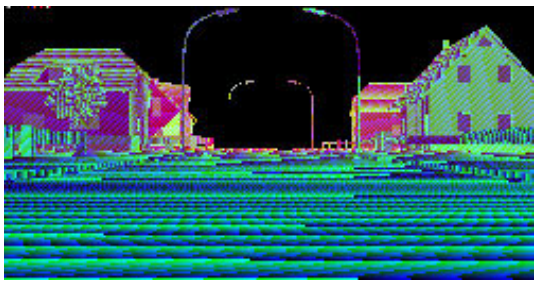
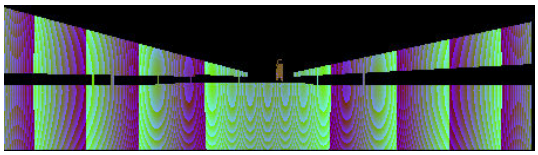
Result

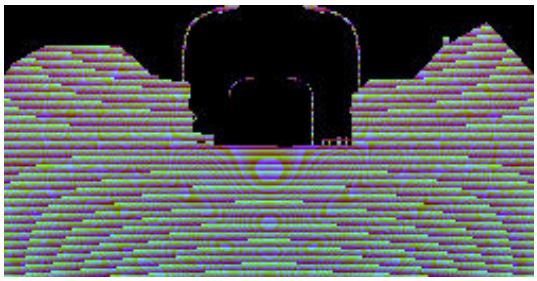
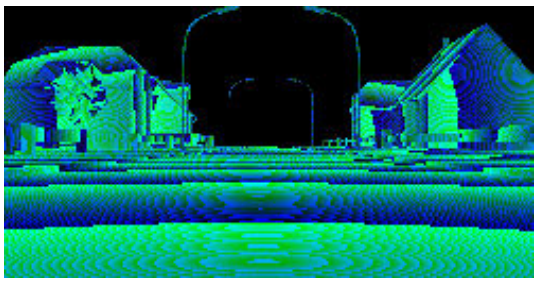
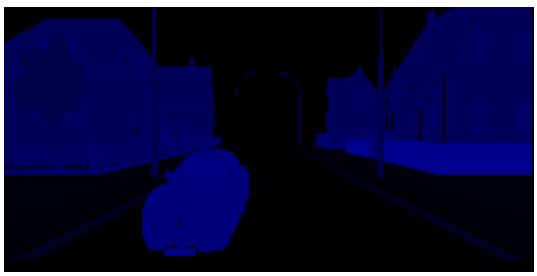
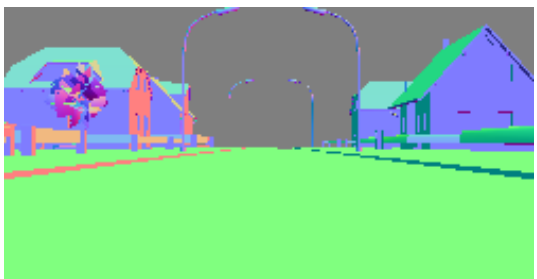
You have set the laser sensor output mode and viewed the selected laser output mode image in the composition window.

Example

The following illustration shows examples of how the output modes can appear in the composition window.

For more information, refer to Output mode.

Output Mode	Composition Window Image
Depth	
Relative velocity	
Azimuth angle	

Output Mode	Composition Window Image
Elevation angle	
Distance	
Normal vector	
Material ID	

Related topics

HowTos

How to Change the Basic Laser Sensor Properties..... 75

References

Laser Sensor Properties..... 141

Configuration of Sensors with SensorSim Application Instances

Introduction

You can use MotionDesk to assign sensors to one or more SensorSim application instances for sensor simulation.

How to Assign Sensors to Multiple SensorSim Application Instances

Objective

You can assign one or more SensorSim application instances for each sensor.

Precondition

- Two sensors must be added to the MotionDesk scene.
- The two sensors must be enabled for sensor simulation.
- Motion data must be assigned to the two sensors.

  For information refer to Common Sensor Properties on page 130.
- You must configure two SensorSim application instances. Each application must be configured to use a separate display screen.

  For more information, refer to SensorSim Application Configuration Settings (Sensor Simulation Manual 🕮).
- You must create a SensorSim application connections for both instances in MotionDesk.

  For more information, refer to How to Add a SensorSim Application Connection on page 85.

Overview

You can configure multiple SensorSim application instances that run on one or more SensorSim PCs in your sensor simulation setup. For more information on configuring multiple SensorSim application instances, refer to Monitoring and Controlling the SensorSim Application (Sensor Simulation Manual 🕮).

You must create connections to each application instance in your MotionDesk project. Refer to How to Add a SensorSim Application Connection on page 85.

In MotionDesk you can then assign the sensors in the project to one or more of the SensorSim application connections to distribute the graphics resources required or to split the sensors across multiple composition windows.

You download the MotionDesk scene to the SensorSim application instances that are running. For each application instances, only the assigned sensor data is downloaded.

The view for the sensor is displayed in the sensor simulation composition window on the display screen you configured for the application instance.

When you modify the field of view properties MotionDesk immediately updates the MotionDesk observer view and the image in the composition window.

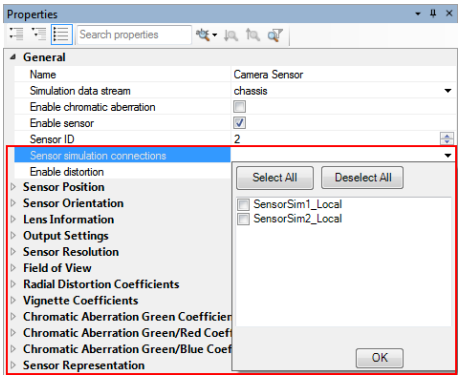
Method

To assign sensors to multiple SensorSim application instances

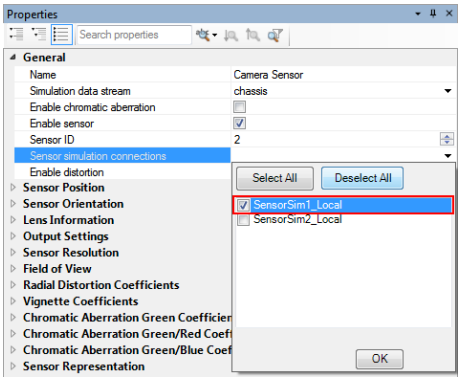
1 Select a sensor, for example, a camera sensor in the Scene Navigator tree to display the Properties pane.

2 Select the Sensor simulation connection list in the General category.

The list displays the names of each of the connections you have setup in the Sensor Simulation Connections dialog.

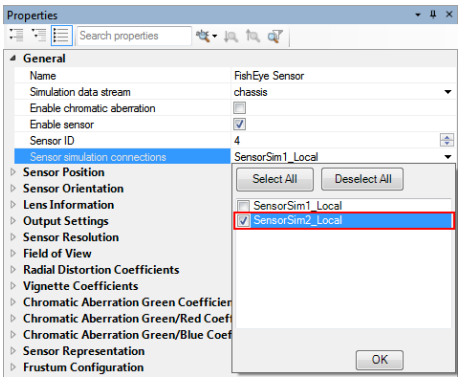


3 Select the first SensorSim application and click OK.



4 Select the second sensor, for example, a fish-eye sensor in the Scene Navigator tree to display the Properties pane.

5 Select the second SensorSim application and click **OK**.



6 Select **Sensor Simulation - Connections - Start All** to start both of the SensorSim application instances.

The SensorSim application instances start and the composition windows for each application instance open in two separate display screens.

Note

You must start the SensorSim application monitoring service to start the SensorSim application instances in MotionDesk. For more information, refer to How to Start and Stop the SensorSim Application Monitoring Service (Sensor Simulation Manual 🕮).

7 Select **Sensor Simulation - Scene Download - Start** to download the scene to the SensorSim application instances.

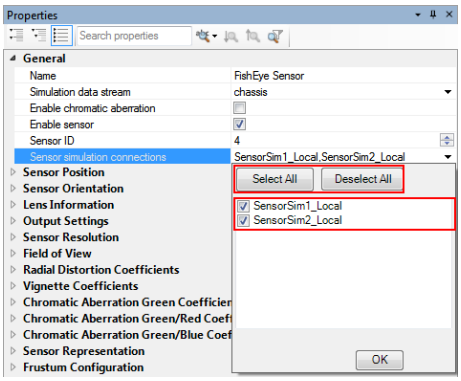
Note

The SensorSim application instance must be started and running to successfully download the scene.

Only the sensor image data for the sensors assigned to the SensorSim application instance is downloaded.

One screen shows the simulation with the image data for the camera sensor. The second shows the image data for the Fish-eye sensor.

8 You can also assign a single sensor to multiple application instances. Select both application instances in the list for the fish-eye sensor.



9 Select **Sensor Simulation - Scene Download - Start** to download the scene to the SensorSim application instances.

The sensor image data for the fish-eye sensors is downloaded to both SensorSim application instances. The output is also displayed in the display screen that displays the image for the camera sensor.

Result

You have assigned two sensors to their own SensorSim application instance and then assigned a sensor to both instances. You downloaded the scene and viewed the output for each instance in the **composition window** on two separate display screens.

Related topics

Basics

Monitoring and Controlling the SensorSim Application (Sensor Simulation Manual 🕮)

HowTos

How to Add a SensorSim Application Connection..... 85
How to Start and Stop the SensorSim Application Monitoring Service (Sensor Simulation Manual 🕮)

References

Common Sensor Properties..... 130

Configuration of SensorSim Application Connections

Introduction

To work with sensor simulation, you must manage the connections to the SensorSim application instances in MotionDesk. You must also download the scene to the SensorSim application that processes the data for raw data sensor simulation.

Where to go from here

Information in this section

How to Add a SensorSim Application Connection.....85
You can add a connection to the SensorSim application instance in MotionDesk for sensor simulation.

How to Delete a SensorSim Application Connection.....88
You can delete a connection to a SensorSim application instance from the sensor simulation environment in MotionDesk.

How to Start Each SensorSim Application Connection.....89
You can start each connection to the SensorSim application instance in MotionDesk for sensor simulation. When you enable the connection, MotionDesk attempts to start the application instance on the SensorSim PC.

How to Start and Stop All SensorSim Application Connections.....91
You can start and stop all of the SensorSim application connections you added in MotionDesk for sensor simulation.

How to Download a Scene to a SensorSim Application.....94
You can download the MotionDesk scene to the SensorSim application instances on the SensorSim PC. The scene can be displayed in the composition window or used to insert raw data into the sensor hardware for sensor simulation.

How to Add a SensorSim Application Connection

Introduction

You can add a connection to a SensorSim application instance in MotionDesk for sensor simulation.

You select the **Connections - Manage** button to load the **Customize SensorSim connections** dialog to manage the SensorSim application connections.

Overview

In MotionDesk, you can add and configure the connections to SensorSim application instances in the sensor simulation architecture for your sensor simulation projects.

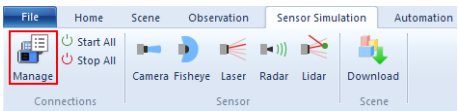
The SensorSim application is an application running on a Windows PC to calculate and render the images of the MotionDesk scene for sensor simulation.

You can add multiple applications, depending on the requirements of the sensor simulation architecture.

Method

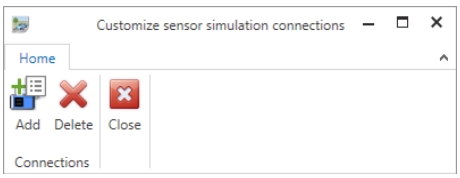
To add a new connection

1 In MotionDesk, select Sensor Simulation - Connections - Manage.



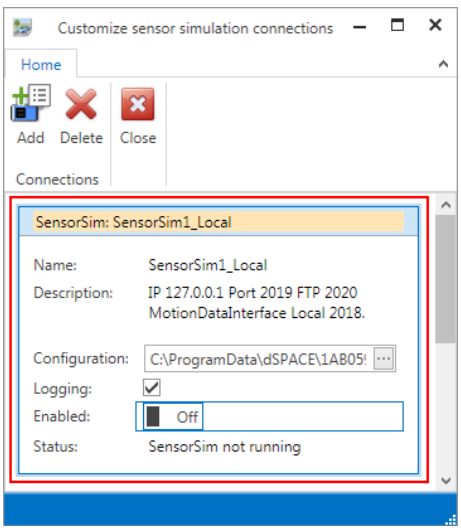
The Customize SensorSim connections dialog opens.

2 Select Add.



3 Specify the connection details:

- Name: Enter a unique name for each SensorSim connection.
- Description: Enter a description for the connection.
- Configuration: You must select a unique SensorSim.UCD file for each connection.
- Logging: Select to display the log messages from the SensorSim application instance in the MotionDesk Messages pane.



Note

SensorSim.ucd configuration file

Before you can enable the connections, you must edit the SensorSim.ucd configuration files and start the monitoring service that controls the SensorSim application on each SensorSim PC.

The UCD file contains the definitions for the connection, for example, the IP address, port numbers, and the folder location for the scene you download from MotionDesk.

For more information, the UCD file and the monitoring service, refer to How to Configure the SensorSim Application Settings File (Sensor Simulation Manual 🕮) and SensorSim Application Configuration Settings (Sensor Simulation Manual 🕮).

4 Repeat these steps to add and configure multiple SensorSim application connections to the sensor simulation environment.

5 Close the dialog to save the connections.

NOTICE

A warning message is displayed if you add multiple connections with the same name or if they share the same configuration file. The monitoring service only starts one of the application instances.

The port numbers must also be unique in the UCD settings file for each application instance that runs on the same SensorSim PC.

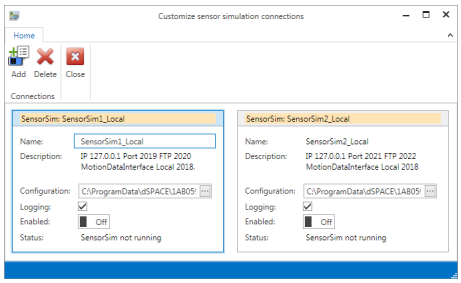
Tip

Observe the Messages pane for reported errors or other information.

Result

You added a SensorSim application connection to the sensor simulation environment.

The Customize SensorSim connections dialog could look like this:



Related topics

HowTos

How to Configure the SensorSim Application Settings File (Sensor Simulation Manual 🕮)

References

SensorSim Connections..... 113

How to Delete a SensorSim Application Connection

Introduction

You can delete a connection to a SensorSim application instance from the sensor simulation environment in MotionDesk.

Overview

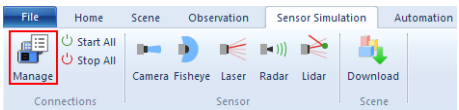
In MotionDesk, you can delete the **SensorSim application** connections from the sensor simulation.

You select the **Connections - Manage** button to load the **Customize SensorSim connections** dialog to manage the SensorSim application connections.

Method

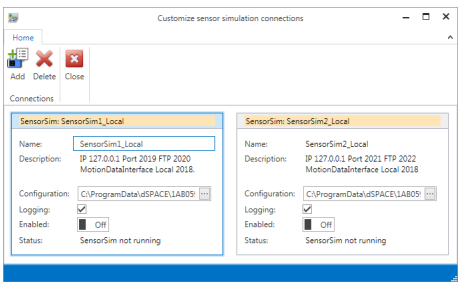
To delete a connection

1 In MotionDesk, select **Sensor Simulation - Connections - Manage**.



The **Customize SensorSim connections** dialog opens.

2 Select the connection you want to delete and click the **Delete** button.



3 Select **Close** to close the dialog and save the changes.

> **Tip**
>
> Observe the **Messages** pane for reported errors or other information.

Result

You deleted the SensorSim application connections from the sensor simulation environment.

Related topics

References

SensorSim Connections..... 113

How to Start Each SensorSim Application Connection

Introduction

You can start each connection to the SensorSim application instance in MotionDesk for sensor simulation. When you enable the connection, MotionDesk attempts to start the application instance on the SensorSim PC.

You select the **Connections - Manage** button to load the **Customize SensorSim connections** dialog to manage the SensorSim application connections.

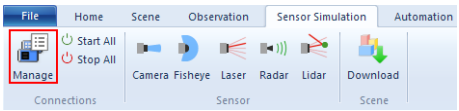
Preconditions

To start and stop the SensorSim application instances with MotionDesk, you must start the application monitoring service. For more information, refer to How to Start and Stop the SensorSim Application Monitoring Service (Sensor Simulation Manual 🕮).

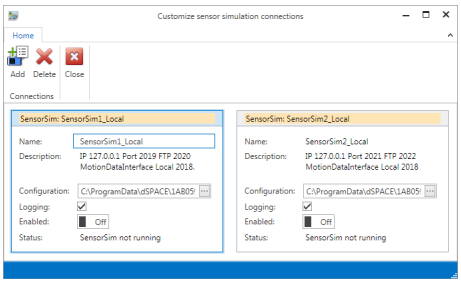
Method

To enable a connection

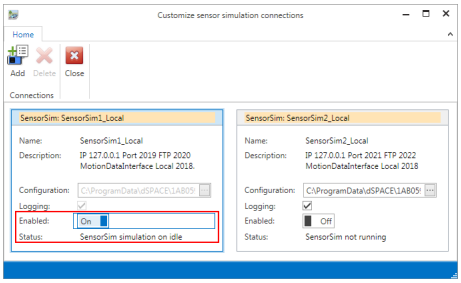
1 In MotionDesk, select **Sensor Simulation - Connections - Manage**.



The **Customize SensorSim connections** dialog opens.



2 Select the connection you want to enable and click the **Enabled** toggle button.



The button is blue and set to **On**.

The **Configuration** field is disabled so the UCD file cannot be changed or removed.

If you have not previously downloaded a scene to the instance, a black screen opens on the display you selected in the SensorSim.ucd configuration file for the started SensorSim application instance.

Tip

You can also manually start each SensorSim application instance from a Command Prompt window. For more information, refer to How to Manually Start SensorSim Application Instances (Sensor Simulation Manual 🕮).

Note

If MotionDesk cannot connect to the SensorSim PC or start the SensorSim application instance, an error is written to the application log file. The error is also displayed in the status field and in the MotionDesk **Messages** pane if **Logging** is selected.

This can occur, for example, if the monitoring service is not running on the SensorSim PC or if there is a port number conflict between multiple SensorSim application instances on the same SensorSim PC.

For more information on the SensorSim application monitoring service, refer to Monitoring and Controlling the SensorSim Application (Sensor Simulation Manual 🕮).

3 You can also stop the connections. Click the **Enabled** toggle button to set it to **Off**.

The composition window closes for the stopped SensorSim application instance you added in MotionDesk.

4 Close the dialog to save the connections. The connections remain **On** or **Off** as you selected.

Tip

Observe the **Messages** pane for reported errors or other information.

Result

You enabled and disabled each SensorSim application connection to start and stop each individual application instance on the SensorSim PC in the Sensor Simulation environment.

Related topics

Basics

Monitoring and Controlling the SensorSim Application (Sensor Simulation Manual 🕮)

HowTos

How to Manually Start SensorSim Application Instances (Sensor Simulation Manual 🕮)
How to Start and Stop the SensorSim Application Monitoring Service (Sensor Simulation Manual 🕮)

References

SensorSim Connections..... 113

How to Start and Stop All SensorSim Application Connections

Introduction

You can start and stop all of the SensorSim application connections you added in MotionDesk for sensor simulation.

You select the **Connections - Manage** button to load the **Customize SensorSim connections** dialog to manage your SensorSim application connections.

Preconditions

To start and stop the SensorSim application instances with MotionDesk, you must start the application monitoring service. For more information, refer to How to Start and Stop the SensorSim Application Monitoring Service (Sensor Simulation Manual 🕮).

Overview

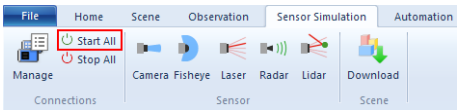
You can start and stop all SensorSim application connections.

1. To start all of the SensorSim application connections you added in MotionDesk, refer to Part 1.
2. To stop all of the SensorSim application connections you added in MotionDesk, refer to Part 2.

Part 1

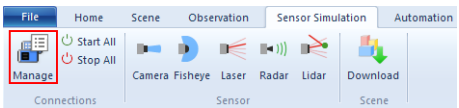
To start all connections

1 In MotionDesk, select Sensor Simulation - Connections - Start All.

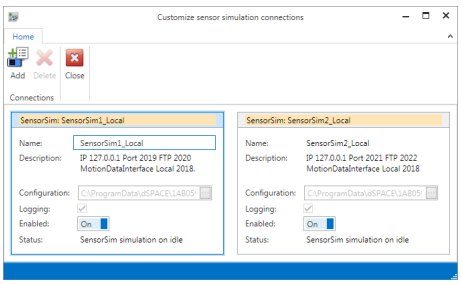


A black screen opens on the display you selected in the SensorSim.ucd configuration file for each successfully started SensorSim application instance you added in MotionDesk.

2 To verify the status of all of the connection you added in MotionDesk, select Connections - Manage to load the Customize SensorSim connections dialog.



3 Check that for all connections the Enabled button is blue and is set to On.



The Configuration field is disabled so the UCD file cannot be changed or removed.

Note

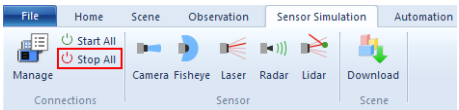
If MotionDesk cannot connect to the SensorSim PC or start the SensorSim application instances, an error is written to the application log file. An error is also displayed in the status field and in the MotionDesk Messages pane if Logging is selected.
This can occur, for example, if the monitoring service is not running on the SensorSim PC or if there is a port number conflict between multiple SensorSim application instances on the same SensorSim PC.

4 Close the dialog to save the connections. The connections remain On and started.

Part 2

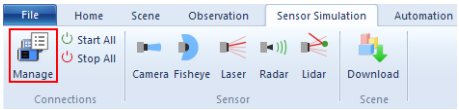
To stop all connections

1 In MotionDesk, select Sensor Simulation - Connections - Stop All.

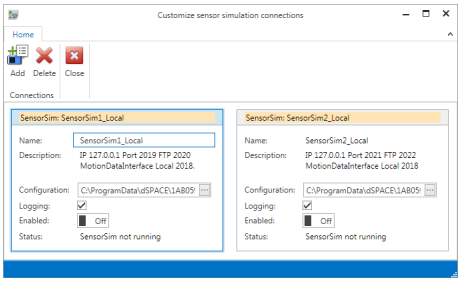


The black screen closes for each successfully stopped SensorSim application instance you added in MotionDesk.

2 To verify the status of all of the connections you added in MotionDesk, select Connections - Manage to load the Customize SensorSim connections dialog.



3 Check that for all connections the Enabled button is black and is set to Off.



Note

If MotionDesk cannot connect to the SensorSim PC or stop the SensorSim application instances, an error is written to the application log file. An error is also displayed in the status field and in the MotionDesk Messages pane if Logging is selected.
This can occur, for example, if the monitoring service or SensorSim application instances are no longer running on the SensorSim PC.
You must start the monitoring service on the SensorSim PC. You must also stop and restart all the connections in MotionDesk.

4 Close the dialog to save the connections. The connections remain Off and stopped.

Result

You started and stopped all of the SensorSim application connections you added in MotionDesk for sensor simulation.

Related topics

HowTos

How to Start and Stop the SensorSim Application Monitoring Service (Sensor Simulation Manual 🕮)

References

SensorSim Connections..... 113

How to Download a Scene to a SensorSim Application

Introduction

You can download the MotionDesk scene to the SensorSim application instances on the SensorSim PC. The scene can be displayed in the composition window or used to insert raw data into the sensor hardware for sensor simulation.

Preconditions

Before you download the scene, you must perform the following actions:

1. Prepare the SensorSim.ucd configuration file for the SensorSim application instance.
2. Start the SensorSim application monitoring service on the SensorSim PC.

   For more information, refer to How to Start and Stop the SensorSim Application Monitoring Service (Sensor Simulation Manual 🕮).
3. Add a **SensorSim application** connection in MotionDesk. You must select the SensorSim.ucd configuration file for the application instance.
4. Enable the connection to start the SensorSim application on the SensorSim PC.
5. Add the sensors to the scene in MotionDesk and configure the sensor properties that you need for sensor simulation.

Overview

The scene in MotionDesk is the input for the image and raw data to validate the sensors in a simulation.

You configure your MotionDesk scene, for example, you add a camera, fish-eye and laser sensor and set the sensor properties.

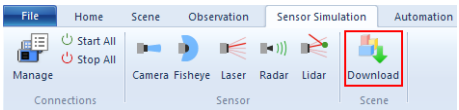
You can download the complete MotionDesk scene to the connected and started SensorSim application instances.

The scene data is downloaded to the folder location on the SensorSim PC that you add in the SensorSim.ucd configuration file, for example in: `%UserProfile%\Documents\dSPACE\SensorSim\1.1\`.

Method

To download a scene to a SensorSim application

1 In MotionDesk, select Sensor Simulation - Scene Download - Start to download the MotionDesk scene.



Tip

Observe the Messages pane for reported errors or other information.

Note

The SensorSim application instance must be running and the connection from MotionDesk must be successful to download a scene from MotionDesk.
The scene data is not placed in a queue and then downloaded when an unreachable application instance reconnects.

2 You can follow the MotionDesk scene in the SensorSim application window. The scene is loaded in the window after the scene is downloaded.

Result

You downloaded the MotionDesk scene to the SensorSim application for sensor simulation with image and raw data.

Related topics

Basics

Configuration of Camera and Fish-Eye Sensors.....21
Configuration of Laser Sensors.....70
Overview of Configuring Sensors in MotionDesk.....11

HowTos

How to Add a SensorSim Application Connection.....85
How to Start and Stop the SensorSim Application Monitoring Service (Sensor Simulation Manual 🕮)

Working with the Material Database Editor

Introduction

You can add, edit, and remove materials and material characteristics used in sensor simulation.

Where to go from here

Information in this section

How to Merge the Material Database.....96
When you start MotionDesk, you can merge the new dSPACE materials in the installed material database with an existing material database file in your custom object library.

How to Search for a Material.....98
You can search and filter for an existing dSPACE or custom material in your material database.

How to Add and Edit a Custom Material.....101
You can add custom materials to your material database.

How to Add and Edit a Material Extended Property.....104
You can add optional extended properties with a default value for all materials in the material database.

How to Remove a Custom Material.....106
You can remove custom materials from your material database.

How to Remove an Extended Material Property.....108
You can remove an extended property from all materials in the material database.

How to Merge the Material Database

Objective

When you start MotionDesk, you can merge the new dSPACE materials in the installed material database with an existing material database file in your custom object library.

Overview

Each time you start MotionDesk, MotionDesk checks if a `MaterialMapping.xml` material database file exists in the custom object library folder, for example, in `%CUSTOM_OBJECT_LIBRARY%\MaterialManagement`. It compares the dSPACE materials in this database with those in the installed database in `<MotionDesk_InstallationPath>\MotionDesk\Assets\Materials`.

If there are differences in the dSPACE materials, an information message is displayed asking if you want to merge the new materials into the custom object library material database file.

Select Yes or No:

- Yes: MotionDesk adds all new dSPACE materials from the material database delivered with the Release into your custom object library `MaterialMapping.xml`. The new materials also inherit the extended properties and the default values you previously added to the database.

  The existing `MaterialMapping.xml` is also saved as a backup in the same folder.
- No: The existing custom `MaterialMapping.xml` is unchanged.

> **Note**
>
> You cannot open the Material Database Editor until the `MaterialMapping.xml` material database has been migrated or a valid file is added to the folder.

If the material database is missing from custom object library folder, the file from the installation is always copied to the folder when you start MotionDesk.

Merge errors MotionDesk produces a log file that details any merge errors. These are also displayed in the Message pane and an information message is shown.

> **⚠ CAUTION**
>
> You must use the Material Database Editor in MotionDesk to manage custom materials and material characteristics. If you manually edit the `MaterialMapping.xml` material database errors can occur when using the editor and the materials.

Method

To merge the material database

1. Start MotionDesk.

   MotionDesk compares the dSPACE materials in the `MaterialMapping.xml` material database in your custom object library.
2. If there are differences in the dSPACE materials, an information message is displayed asking if you want to merge the new materials into the custom object library material database file.

   Select Yes to merge the new dSPACE materials from the installed version with the existing `MaterialMapping.xml` material database in your custom object library.

   The existing `MaterialMapping.xml` is saved as a backup in the same folder.

3 Check the **Messages** pane to see if any merge errors occurred. You can also open the MotionDesk log file.

> **Note**
>
> If errors occur during the merge, the relevant material names, IDs, and preview colors are shown in the messages pane.
> For more information, refer to Warning When Merging the MaterialMapping.xml on page 159.

4 In MotionDesk, click **Materials - Manage** on the Home ribbon to open the **Material Database Editor**.

5 Click the **dSPACE Materials** node and review the new dSPACE materials and their properties.

The new dSPACE materials are available in the tree and contain all of the extended properties and default values that you previously added to the database.

6 Click the **Custom Materials** node and review the custom materials.

The custom materials are not changed by the merge.

Result

You merged the dSPACE materials from the installed material database to the existing material database file in your custom object library. You reviewed the new materials in the Material Database Editor.

Related topics

Basics

Overview of Material Management (Sensor Simulation Manual 🕮)

HowTos

How to Change the Location of the Custom Objects Library (MotionDesk Custom Object Library Management 🕮)
Warning When Merging the MaterialMapping.xml..... 159

References

Material Database (Sensor Simulation Manual 🕮)

How to Search for a Material

Objective

You can search and filter for an existing dSPACE or custom material in your material database.

Overview

You can use the search field to filter the list of dSPACE and custom materials based on text and numbers that you add in the search field. The search results displayed are the materials that contain the search text in the material name and ID fields.

For example, if you type a number in the search field, materials in the database that contain this number as a part or the whole in the name or material ID are displayed.

You can also use the keyword search by typing the `name:` and `id:` strings followed by the text or number to further refine your search. To use the keyword search, refer to Method 2 on page 100.

Method 1

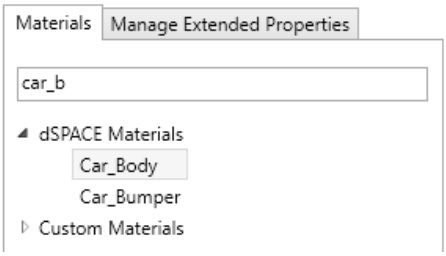
To search for a material

1 In MotionDesk, click Materials - Manage on the Home ribbon to open the Material Database Editor.

2 On the Materials page, type text into the search field.

3 Click Enter.

The materials that contain the text string anywhere in the material name are shown in the dSPACE Materials and Custom Materials nodes.

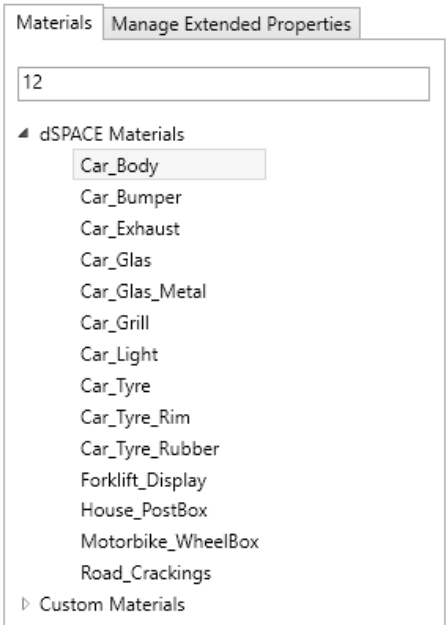


4 Press X to clear the text.

All materials are displayed again.

5 Type a number into the search field and click Enter.

The materials that contain the number anywhere in the material ID in part or whole or in the material name are shown in the dSPACE Materials and Custom Materials nodes.



Result

You searched your material database for dSPACE and custom materials that contain the text or the number.

Method 2

To search using the keywords

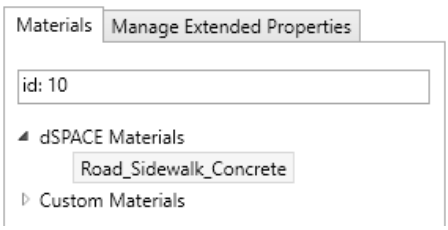
1. In the search field, type `name:` followed by text, for example, `name: car` or `name: 1`, and select Enter

   The materials that contain the text string `car` or `1` only in the material name are shown in the dSPACE Materials and Custom Materials nodes.

2. In the search field, type `id:` followed by a number, for example, `id: 10`, and select Enter.

   The material that matches exactly the material ID is shown.

   For example, `Road_Sidewalk_Concrete` with the material ID `10` is shown in the dSPACE Materials node.

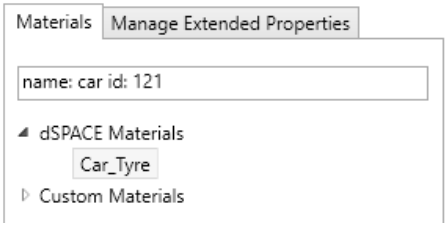


3. For a refined search, use a combined name and ID search.

   Type `name:` followed by text, for example, `name: car` and select Enter.

   The results are reduced. The materials that contain the text string `car` only in the material name are shown in the dSPACE Materials and Custom Materials nodes.

4 After `name: car`, type `id:` followed by a number, for example, `id: 121` and select Enter.



The results are further reduced. The material that contains both the text and the exact material ID number are displayed in the **dSPACE Materials** and **Custom Materials** nodes.

Result

You searched for dSPACE and custom materials that contain the text and numbers in the name or ID.

What's next

You will learn how to add custom materials.

Related topics

Basics

Overview of Material Management (Sensor Simulation Manual 🕮)

References

Material Database Editor..... 146
Material Properties..... 153

How to Add and Edit a Custom Material

Objective

You can add custom materials to your material database.

Overview

When you start MotionDesk, MotionDesk compares the dSPACE materials in the `MaterialMapping.xml` material database in your 3-D customer object library, for example in

`<3-D customer object library>\MaterialManagement`.

If there are differences in the dSPACE materials, an information message is displayed asking if you want to merge the new materials into the custom object library material database file.

You can then add custom materials to your `MaterialMapping.xml` material database using the MotionDesk Material Database Editor.

Note

You cannot add dSPACE materials or edit the name and ID of the existing dSPACE materials.

Method

To add and edit a custom material

1. In MotionDesk, click **Materials - Manage** on the Home ribbon to open the **Material Database Editor**.
2. On the **Materials** page, expand the **Custom Materials** node to display the existing custom materials
3. Click the **Add Material** button or right-click **Custom Materials** and select **Add Custom Material** on the context menu.

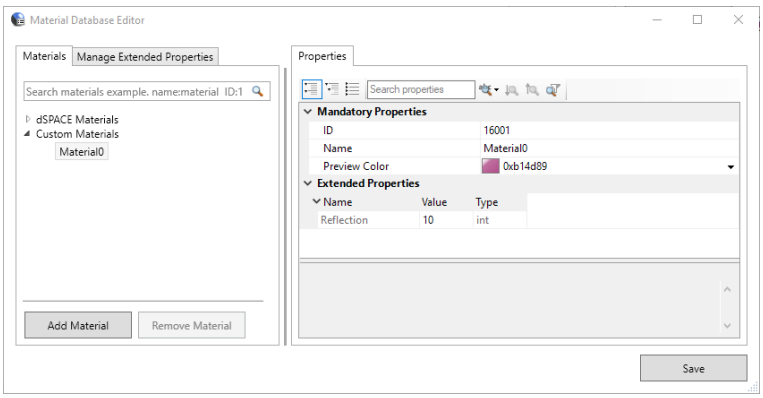
   The new material is added to the **Custom Materials** node.
4. In the properties pane, expand the **Mandatory Properties** category.
   - **ID**: The ID used for the new material is the next available ID in the sequence.

     Note

     The ID values `16001` to `31999` are available for custom materials.

   - **Name**: The default name is **Material0**.

     If **Material0** is already used by an existing material, the next available number in the sequence is used, for example, **Material1**.



5. In the **Name** field, type the new name for the material.

   Note

   The name must be unique . It must not be used by any existing dSPACE or custom material and must not contain any white spaces.

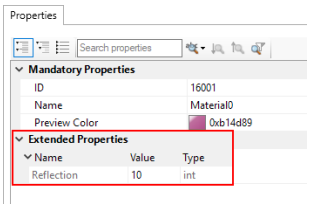
6 In the properties pane, expand the **Extended Properties** category.

All extended properties that you previously added in the **Extended Properties** tab are displayed with their default values.

7 In the **Value** field, type the new value for each of the extended properties for this material.

Note

The default value must meet the requirements of the property type. For example, only numerical characters and one decimal point or comma are permitted for the double property type.



8 Click **Save** to confirm all the changes.

Result

You added a new custom material to your material database. The material includes all the existing extended properties and their default values. You also edited the extended property value for the material.

What's next

You will learn how to add extended material properties.

Related topics

Basics

Overview of Material Management (Sensor Simulation Manual 🕮)

HowTos

How to Add and Edit a Material Extended Property..... 104
How to Remove a Custom Material..... 106

References

Manage Extended Properties..... 149
Material Database Editor..... 146
Material Properties..... 153
Materials..... 147

How to Add and Edit a Material Extended Property

Objective

You can add optional extended properties with a default value for all materials in the material database.

Overview

You add an extended property to the material database that is assigned to all existing and new materials. The default value that you specify for the extended property is applied to the value field of all materials after you click the plus icon.

The extended properties values relate to a texture file that contains the behavior characteristics for the material. This is used when the SensorSim application renders the data to produce radar and lidar sensor data for sensor simulation.

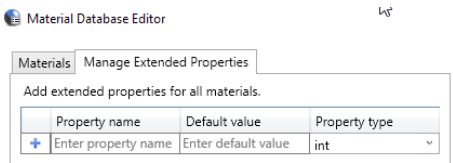
Note

You can edit the default value of an extended property after you add and confirm the extended property with the plus icon.
If you change the default value for an extended property in the Manage Extended Properties pane, the actual value for the extended property is not changed for the existing materials in the Materials pane. It is only applied to new custom materials.

Method

To add and edit an extended material property

1. In MotionDesk, click Materials - Manage on the Home ribbon to open the Material Database Editor.
2. In the Manage Extended Properties tab, type a property name without white spaces in the Property name field on the new empty row.

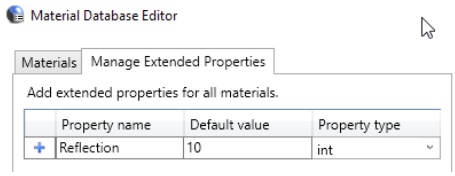


3. In the Property type column, select the property type from the drop-down list. You must select the integer, string, or double property type.

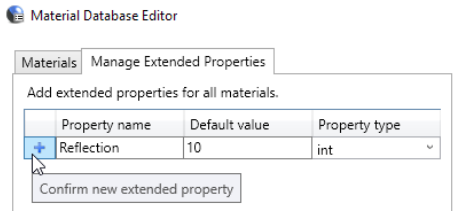
Note

The string property type supports the extended properties and values imported when working with the lidar sensors in sensor simulation.

4. In the Default value column, type the value that you want to apply to the extended property for all the materials in the database. This must meet the requirements of the property type.



5 Click the + icon in the table to confirm the new extended property.



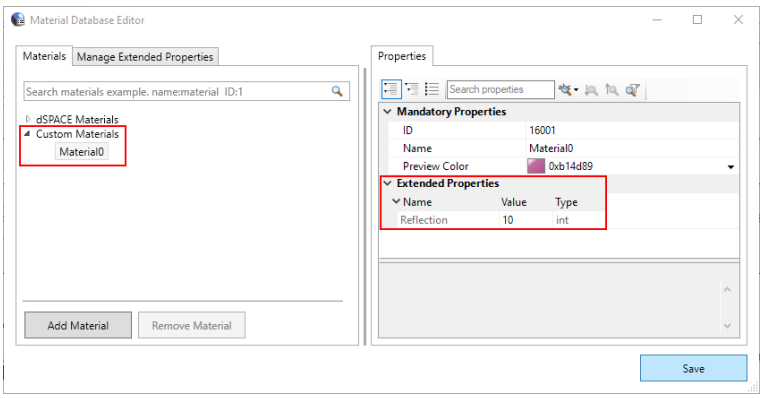
The extended property is applied to all the materials when you click the plus icon.

Note

Warnings are displayed if a property with the same name exists, the name contains whitespaces, the property type is not selected, and if the default value does not meet the requirements of the property type.

6 Click the **Material** tab and select an existing custom or dSPACE material.

In the **Manage Extended properties** group, the new extended property is displayed with the default value that you set in the **Extended properties** tab. All other previously added extended properties in the database are also displayed for the material.



7 In the **Extended Properties** tab, change the value of the **Default value** for an extended property.

Note

You cannot change the property type after you add the extended property by clicking + icon.

8 In the Materials tab, add a new material.
The extended property of the new material has the new default value.

Note

If you change the default value for an extended property in the Manage Extended Properties pane, the actual value for the extended property is not changed for the existing materials in the Materials pane. It is only applied to new custom materials.

9 Click Save to save the extended property to the material database.

Result

You added an extended property to the material database with a unique name, a property type for the value, and a default value. You also checked the extended property for an existing material.

What's next

You will learn how to remove custom materials.

Related topics

Basics

Overview of Material Management (Sensor Simulation Manual 🕮)

HowTos

How to Add and Edit a Custom Material..... 101
How to Remove an Extended Material Property..... 108

References

Manage Extended Properties..... 149

How to Remove a Custom Material

Objective

You can remove custom materials from your material database.

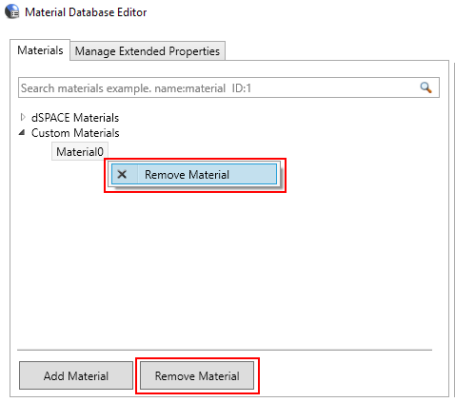
Method

To remove a custom material

1 In MotionDesk, click Materials - Manage on the Home ribbon to open the Material Database Editor.

2 On the Materials page, expand the Custom Materials node to display the existing custom materials

3 Click the **Remove Material** button or right-click on a selected custom material and select **Remove Material** on the context menu.



The custom material is removed from the **Custom Materials** node.

Note

You cannot remove a dSPACE material. Therefore, there is no context menu for dSPACE materials.

4 Click **Yes** in the following warning message: `Do you want to delete this material?`

Note

If you incorrectly removed a material, exit the dialog without saving and reload the material database editor.

5 Select **Save**.

Result

You removed a custom material from your material database.

What's next

You will learn how to remove extended material properties.

Related topics

Basics

Overview of Material Management (Sensor Simulation Manual 🕮)

HowTos

How to Add and Edit a Custom Material..... 101

References

Material Properties..... 153

How to Remove an Extended Material Property

Objective

You can remove an extended property from all materials in the material database.

Note

You cannot remove an extended property from a single specific material in the Material pane.

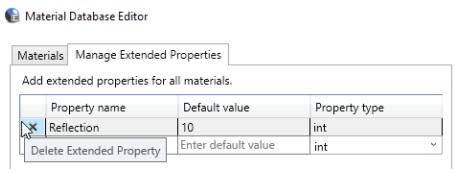
Method

To remove an extended material property

1 In MotionDesk, click Materials - Manage on the Home ribbon to open the Material Database Editor.

2 On the Extended properties pane, select an extended property in the table.

3 Click the × icon on the selected row.



4 Click Yes in the following warning message: `This extended property is assigned to all materials. Are you sure you want to delete it?`

The extended property is removed from the table. The extended property is also removed from all dSPACE and custom materials.

Note

If you incorrectly removed an extended property, exit the dialog without saving and reopen the Material Database Editor.

5 Click **Save**.

6 Click the **Material** tab and select an existing custom or dSPACE material.

In the **Extended properties** group, the removed extended property is removed from the materials. All other extended properties remain.

Result

You removed an extended property from all materials in the material database.

What's next

You will learn how to manually edit the material database.

Related topics

Basics

Overview of Material Management (Sensor Simulation Manual 🕮)

HowTos

How to Add and Edit a Material Extended Property..... 104

References

Manage Extended Properties..... 149

Reference Information

Where to go from here

Information in this section

Sensor Simulation Dialogs and Pages..... 112
MotionDesk provides various dialog pages to specify the settings for Sensor Simulation control. This includes the control of the SensorSim application instances and the sensors.

Sensor Simulation and Sensor Commands..... 115
MotionDesk provides various commands to control of SensorSim applications and sensors, which are accessible via the context menus.

Sensor Simulation and Sensor Properties..... 129
MotionDesk provides a properties pane for configuring the settings for Sensor Simulation and the sensors.

Material Manager Commands..... 146
MotionDesk provides a dialog for adding, removing, and editing materials for sensor simulation.

Material Manager Properties..... 153
MotionDesk provides a properties pane for editing the properties of the materials in the database for sensor simulation.

Sensor Simulation Dialogs and Pages

Introduction

MotionDesk provides various dialog pages to specify the settings for Sensor Simulation control. This includes the control of the SensorSim application instances and the sensors.

Where to go from here

Information in this section

Sensor Simulations Options Page..... 112
To specify the display that is used for the Sensor Simulation composition window to display the image for sensor simulation.

SensorSim Connections..... 113
The Customize SensorSim connections dialog provides functions to add, delete, and manage connections to the SensorSim application instances for the sensor simulation environment.

Sensor Simulations Options Page

Access

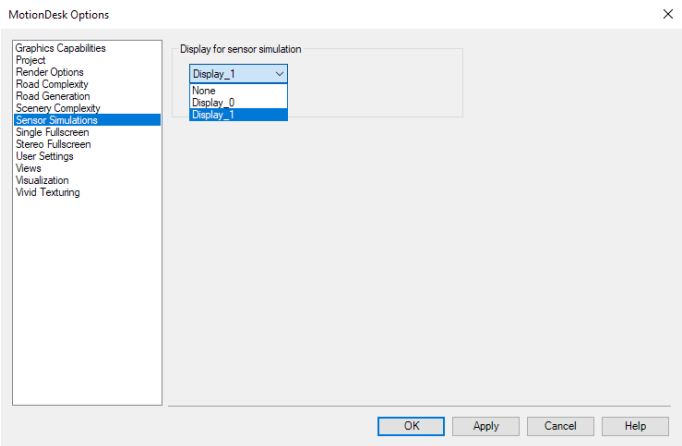
This page is part of the MotionDesk Options dialog.

Purpose

To specify the display that is used for the Sensor Simulation composition window to display the image for sensor simulation.

Description

Select the display for the sensor composition window.



Dialog settings

Display for sensor simulation Lets you select the display that is used for the Sensor Simulation composition window to display the sensor data images for sensor simulation.

Related topics

HowTos

How to Configure a MotionDesk Screen for Sensor Simulation..... 18

References

MotionDesk Options (MotionDesk Basics 🕮)

SensorSim Connections

Access

You can access this dialog via:

Ribbon	Sensor Simulation - Connections - Manage
Context menu of	None
Shortcut key	None
Icon	
Others	None

Purpose

The Customize SensorSim connections dialog provides functions to add, delete, and manage connections to the SensorSim application instances for the sensor simulation environment.

Dialog ribbon commands

Add Lets you add a new connection to a SensorSim application instance to the sensor simulation environment to calculate raw data for the camera and laser sensors validation.

Delete Lets you delete the selected connection to the SensorSim application instance from the sensor simulation environment.

Close Lets you close the Customize SensorSim connections dialog. All changes you make to the connections are automatically saved when you close the dialog.

Dialog connections settings

Name Lets you specify the name of the new or an existing connection. The name for each SensorSim connection must be unique. A warning is displayed if multiple SensorSim connections have the same name when you try to close the dialog.

Description Lets you specify a description of the new or an existing connection.

Configuration Lets you select a configuration file with the UCD extension that contains the connection details for the SensorSim application instance.

The configuration file includes the IP address, port number, FTP port number as well as the data and log file paths for the SensorSim application instance. If MotionDesk uses the localhost for the SensorSim connection.

You must create a separate configuration file for each SensorSim application instance. The files must be stored on the MotionDeskPC.

Logging Lets you specify whether to enable logging for the SensorSim application instance. If logging is enabled; error, warning and info log messages are displayed in the MotionDesk messages pane.

Enabled Lets you start or stop the SensorSim application instance on a local or remote machine individually. You move the **Enable** slider to **On** or **Off**.

The SensorSim connection is returned to **Off** if MotionDesk cannot connect to the monitoring service on the SensorSim PC.

A configuration file must exist to start the SensorSim application instance.

Status Provides the status of the SensorSim application instance.

The monitoring service controls the SensorSim application instances on the SensorSim PC and provides the status to the MotionDesk PC.

Status messages:

- SensorSim not running
- SensorSim starting
- SensorSim initializing
- SensorSim loading a scene
- SensorSim simulation on idle
- SensorSim simulation running
- SensorSim shutting down
- Monitoring service not accessible

Related topics

HowTos

How to Add a SensorSim Application Connection..... 85
How to Delete a SensorSim Application Connection..... 88
How to Start Each SensorSim Application Connection..... 89

References

Manage SensorSim Connections..... 126

Sensor Simulation and Sensor Commands

Introduction

MotionDesk provides various commands to control of SensorSim applications and sensors, which are accessible via the context menus.

Where to go from here

Information in this section

Create Camera Sensor 116
To create a camera sensor.

Create Fish-Eye Camera Sensor 117
To create a fish-eye camera sensor.

Create Laser Sensor 118
To create a laser sensor.

Create Radar Sensor 119
To create a radar sensor.

Create Lidar Sensor 121
To create a lidar sensor.

Delete (Sensor) 122
To delete a sensor.

Enable Sensor Simulation 123
To enable or disable sensor simulation.

Open/Close Composition Window 123
To open or close the composition window for the display of sensor images.

Keep Composition Window Open 124
To keep the composition window open after the simulation is stopped.

Hide Visualization Views 125
Lets you specify to hide the visualization views when the simulation starts.

Hide Sensor MetaData 125
Lets you specify whether to hide or show the sensor metadata line in the composition window.

Manage SensorSim Connections 126
To open the dialog to manage the connections to the SensorSim application instances for sensor simulation.

Start All SensorSim Connection Instances 127
To start all of the SensorSim application instances on the local or remote PCs that you manage on the MotionDesk PC and that are successfully connected with a SensorSim monitoring service.

Stop All SensorSim Connection Instances..... 127
To stop all of the SensorSim application instances on the local or remote PCs that you manage on the MotionDesk PC and that are successfully connected with a SensorSim monitoring service.

Scene Download..... 128
To start the MotionDesk scene download to the SensorSim applications.

Create Camera Sensor

Access

You can access this command via:

Ribbon	Sensor Simulation - Sensor
Context menu of	Sensors in Scene Navigator
Shortcut key	None
Icon	

Purpose

To create a new camera sensor.

Description

In MotionDesk you can add and configure any number of camera sensors using the basic MotionDesk license.

To use the camera sensors with Sensor Simulation, you must activate the MDD_SENSOR_CAMERA license. The license allows you to download a MotionDesk scene that contains camera sensors to the SensorSim application instances or to start the simulation and open the composition window.

Note

Sensor license activation
If you have not activated the licenses for each sensor type that you added to the scene in the 3-D View, all sensors in the scene are deactivated. The sensors are reactivated when you install and activate the licenses.

Result

A camera sensor is created and added to the Sensors tree in the Scene Navigator.

Related topics

Basics

Licenses for Sensor Simulation (Sensor Simulation Overview 🕮)

HowTos

How to Insert a Camera Sensor..... 28

References

Camera and Fish-Eye Sensor Properties..... 132
Delete (Sensor)..... 122

Create Fish-Eye Camera Sensor

Access

You can access this command via:

Ribbon	Sensor Simulation - Sensor
Context menu of	Sensors in Scene Navigator
Shortcut key	None
Icon	

Purpose

To create a new fish-eye camera sensor.

Description

In MotionDesk you can add and configure any number of fish-eye camera sensors using the basic MotionDesk license. You cannot create sensors during simulation.

To use the fish-eye camera sensors with Sensor Simulation, you must activate the MDD_SENSOR_CAMERA license. The license allows you to download a MotionDesk scene that contains fish-eye camera sensors to the SensorSim application instances or to start the simulation and open the composition window.

Note

Sensor license activation
If you have not activated the licenses for each sensor type that you added to the scene in the 3-D View, all sensors in the scene are deactivated. The sensors are reactivated when you install and activate the licenses.

Result

A fish-eye camera sensor is created and added to the Sensors tree in the Scene Navigator.

Related topics

Basics

Licenses for Sensor Simulation (Sensor Simulation Overview 🕮)

HowTos

How to Insert a Camera Sensor..... 28

References

Camera and Fish-Eye Sensor Properties..... 132
Delete (Sensor)..... 122

Create Laser Sensor

Access

You can access this command via:

Ribbon	Sensor Simulation - Sensor
Context menu of	Sensors in Scene Navigator
Shortcut key	None
Icon	

Purpose

To create a new laser sensor.

Description

In MotionDesk you can add and configure any number of laser sensors using the basic MotionDesk license.

To use the laser sensors with Sensor Simulation, you must activate the MDD_SENSOR_LIDAR license. The license allows you to download a MotionDesk scene that contains laser sensors to the SensorSim application instances or to start the simulation and open the composite window.

Note

Sensor license activation

If you have not activated the licenses for each sensor type that you added to the scene in the 3-D View, all sensors in the scene are deactivated. The sensors are reactivated when you install and activate the licenses.

Result

A laser sensor is created and added to the **Sensors** tree in the **Scene Navigator**.

Related topics

Basics

Licenses for Sensor Simulation (Sensor Simulation Overview 🕮)

HowTos

How to Insert a Laser Sensor 73

References

Delete (Sensor) 122
Laser Sensor Properties 141

Create Radar Sensor

Access

You can access this command via:

Ribbon	**Sensor Simulation - Sensor**
Context menu of	**Sensors** in **Scene Navigator**
Shortcut key	None
Icon	

Purpose

To create a new radar sensor.

Description

To use the radar sensors with Sensor Simulation, you must activate the MDD_SENSOR_RADAR license.

Note

Radar sensor module

To create radar sensors with MotionDesk to use with Sensor Simulation, you must install the Radar Sensor Module add-in and the required licenses from dSPACE. The documentation for Radar Sensor Module is included in the installation package.

For more information, contact your local dSPACE representative.

Note

NVIDIA CUDA 10.2 graphics card support

To create and use radar and lidar sensors for sensor simulation in MotionDesk, as of MotionDesk 4.7, you must have an NVIDIA graphics card that supports the NVIDIA CUDA Toolkit 10.2. (MotionDesk versions 4.4 to 4.6 require NVIDIA CUDA Toolkit 10.0.)

The software also supports hardware accelerated ray tracing, which is only possible with RTX graphics cards and the NVIDIA CUDA Toolkit 10.2, for example, the NVIDIA Quadro RTX 6000 or RTX2080TI.

For more information on hardware requirements, refer to Additional Requirements for the SensorSim Application (Installing dSPACE Software).

Result

A radar sensor is created and added to the **Sensors** tree in the **Scene Navigator**.

Related topics

Basics

Licenses for Sensor Simulation (Sensor Simulation Overview 🕮)

HowTos

How to Insert a Radar Sensor (MotionDesk Radar Sensor Module 🕮)

References

Delete (Sensor)..... 122
Radar Sensor Properties (MotionDesk Radar Sensor Module 🕮)

Create Lidar Sensor

Access

You can access this command via:

Ribbon	Sensor Simulation - Sensor
Context menu of	Sensors in Scene Navigator
Shortcut key	None
Icon	

Purpose

To create a new lidar sensor.

Description

To use the lidar sensors with Sensor Simulation, you must activate the MDD_SENSOR_LIDAR license.

Note

Lidar sensor module

To create lidar sensors with MotionDesk that can be used with Sensor Simulation, you must install the Lidar Sensor Module and the sensor module license from dSPACE. The documentation for Lidar Sensor Module is included in the installation package.

For more information, contact your local dSPACE representative.

Note

NVIDIA CUDA 10.2 graphics card support

To create and use radar and lidar sensors for sensor simulation in MotionDesk, as of MotionDesk 4.7, you must have an NVIDIA graphics card that supports the NVIDIA CUDA Toolkit 10.2. (MotionDesk versions 4.4 to 4.6 require NVIDIA CUDA Toolkit 10.0.)

The software also supports hardware accelerated ray tracing, which is only possible with RTX graphics cards and the NVIDIA CUDA Toolkit 10.2, for example, the NVIDIA Quadro RTX 6000 or RTX2080TI.

For more information on hardware requirements, refer to Additional Requirements for the SensorSim Application (Installing dSPACE Software).

Result

A lidar sensor is created and added to the Sensors tree in the Scene Navigator.

Related topics

Basics

Licenses for Sensor Simulation (Sensor Simulation Overview 🕮)

HowTos

How to Insert a Lidar Sensor (MotionDesk Lidar Sensor Module 🕮)

References

Delete (Sensor)..... 122

Delete (Sensor)

Access

You can access this command via:

Ribbon	None
Context menu of	Camera or Laser sensor in Scene Navigator
Shortcut key	`Delete`
Icon	None

Purpose

To delete a sensor.

You cannot delete sensors during simulation.

Result

The selected sensor is deleted. It is removed from the Sensors tree in the Scene Navigator.

Related topics

References

Create Camera Sensor..... 116
Create Laser Sensor..... 118

Enable Sensor Simulation

Access

You can access this command via:

Ribbon	None
Context menu of	Sensors in Scene Navigator
Shortcut key	None
Icon	None
Others	Via Sensor Simulation properties

Purpose

To enable or disable sensor simulation.

Result

When sensor simulation is disabled, the sensor is not displayed in the scene and the composition window is closed.

Related topics

HowTos

How to Start Each SensorSim Application Connection..... 89

References

Sensor Simulation Properties..... 129

Open/Close Composition Window

Access

You can access this command via:

Ribbon	None
Context menu of	Sensors in Scene Navigator
Shortcut key	None
Icon	Open/Close composition window
Others	Via Sensor Simulation properties

Purpose

To open or close the composition window for the display of sensor images.

Description

The composition window shows the image for sensor simulation. It opens in full screen on the display that you have selected on the **Sensor Simulations** page of the **MotionDesk Options** dialog.

Result

The composition window is open or closed.

Related topics

References

Keep Composition Window Open..... 124
Sensor Simulation Properties..... 129

Keep Composition Window Open

Access

You can access this command via:

Ribbon	None
Context menu of	**Sensors** in **Scene Navigator**
Shortcut key	None
Icon	None
Others	Via **Sensor Simulation** properties

Purpose

To keep the composition window open after the simulation is stopped.

Result

The composition window stays open or is closed after the simulation is stopped.

Related topics

References

Open/Close Composition Window..... 123
Sensor Simulation Properties..... 129

Hide Visualization Views

Access

You can access this command via:

Ribbon	None
Context menu of	**Sensors** in **Scene Navigator**
Shortcut key	None
Icon	None
Others	Via **Sensor Simulation** properties

Purpose

Lets you specify to hide the visualization views when the simulation starts.

Result

The visualization views are hidden when the simulation starts.

Related topics

References

Sensor Simulation Properties..... 129

Hide Sensor MetaData

Access

You can access this command via:

Ribbon	None
Context menu of	**Sensors** in **Scene Navigator**
Shortcut key	None
Icon	None
Others	Via **Sensor Simulation** properties

Purpose

Lets you specify whether to hide or show the sensor metadata line in the composition window.

Result

The sensor metadata line is hidden in the composition window when the simulation starts.

Related topics

References

Sensor Simulation Properties..... 129

Manage SensorSim Connections

Access

You can access this command via:

Ribbon	Sensor Simulation - Connections
Context menu of	None
Shortcut key	None
Icon	
Others	None

Purpose

To open the dialog to manage the connections to the SensorSim application instances for sensor simulation.

Result

When Manage is selected, the Customize SensorSim connections dialog opens for you to add, delete, and manage the connections to the SensorSim application instances for sensor simulation.

Related topics

HowTos

How to Add a SensorSim Application Connection..... 85
How to Delete a SensorSim Application Connection..... 88

References

SensorSim Connections..... 113

Start All SensorSim Connection Instances

Access

You can access this command via:

Ribbon	Sensor Simulation - Connections
Context menu of	None
Shortcut key	None
Icon	Start All
Others	None

Purpose

To start all of the SensorSim application instances on the local or remote PCs that you manage on the MotionDesk PC and that are successfully connected with a SensorSim monitoring service.

Result

When Start All is selected, the SensorSim application instances on the local or remote PCs that you configure on the MotionDesk PC are started.

Related topics

HowTos

How to Add a SensorSim Application Connection..... 85
How to Delete a SensorSim Application Connection..... 88

References

SensorSim Connections..... 113

Stop All SensorSim Connection Instances

Access

You can access this command via:

Ribbon	Sensor Simulation - Connections
Context menu of	None
Shortcut key	None
Icon	Stop All
Others	None

Purpose

To stop all of the SensorSim application instances on the local or remote PCs that you manage on the MotionDesk PC and that are successfully connected with a SensorSim monitoring service.

Result

When **Stop All** is selected, the SensorSim application instances on the local or remote PCs that you configure on the MotionDesk PC are stopped.

Related topics

HowTos

How to Add a SensorSim Application Connection..... 85
How to Delete a SensorSim Application Connection..... 88

References

SensorSim Connections..... 113

Scene Download

Access

You can access this command via:

Ribbon	**Sensor Simulation - Scene**
Context menu of	None
Shortcut key	None
Icon	
Others	None

Purpose

To download the MotionDesk scene to all of the **Enabled** SensorSim application instances.

Result

When **Download** is selected, MotionDesk downloads the scene to all of the **Enabled** SensorSim application instances.

Related topics

HowTos

How to Download a Scene to a SensorSim Application..... 94

Sensor Simulation and Sensor Properties

Introduction

MotionDesk provides a properties pane for configuring the settings for Sensor Simulation and the sensors.

Where to go from here

Information in this section

Sensor Simulation Properties..... 129
To specify the properties for Sensor Simulation in MotionDesk.

Common Sensor Properties..... 130
To specify the common properties of camera, fish-eye, laser, radar, and lidar sensors for Sensor Simulation. The common properties are on the properties pane for all sensor types.

Camera and Fish-Eye Sensor Properties..... 132
To specify the properties of camera and fish-eye sensors for Sensor Simulation.

Camera and Fish-Eye Sensor Lens Configuration Properties..... 137
To specify the lens configuration and distortion properties for camera and fish-eye sensors for Sensor Simulation.

Laser Sensor Properties..... 141
To specify the properties of a laser sensor for Sensor Simulation.

Radar Sensor Properties..... 144
To specify the properties of a radar sensor for Sensor Simulation.

Lidar Sensor Properties..... 144
To specify the properties of a lidar sensor for Sensor Simulation.

Sensor Simulation Properties

Purpose

To specify the properties for Sensor Simulation in MotionDesk.

Sensor Simulation

The Sensor Simulation properties pane contains the following properties:

Enable sensor simulation Lets you enable the simulation of sensors.

Enable shared memory interface Lets you enable the shared memory interface. When you use the shared memory, you can download the MotionDesk scene and the sensor data to be read using an external tool. For more

information, refer to Basics on Shared Memory Access (Sensor Simulation Manual 🕮).

Hide sensor metadata Lets you specify whether to hide or show the metadata line in the composition window.

Hide visualization views Lets you specify to hide the MotionDesk scene visualization views when the simulation starts.

Keep composition window open Lets you specify whether the composition window stays open after the simulation is stopped.

Name Displays the name of the sensor settings.

Open/Close composition window The button lets you open or close the composition window. The composition window shows the image for sensor simulation. It opens in full screen on the display that you selected on the **Sensor Simulations** page of the **MotionDesk Options** dialog. The composition window also opens when you start the SensorSim application instance.

Time stamp data stream Lets you specify the instrument data stream (64-bit integer value) that provides time stamps of the current simulation data frame from the simulation model. This property is optional. It is mainly used for performance tests.

Related topics

Basics

Basics on Shared Memory Access (Sensor Simulation Manual 🕮)

HowTos

How to Configure a MotionDesk Screen for Sensor Simulation..... 18

References

Sensor Simulation and Sensor Commands..... 115
Sensor Simulations Options Page..... 112

Common Sensor Properties

Purpose

To specify the common properties of camera, fish-eye, laser, radar, and lidar sensors for Sensor Simulation. The common properties are on the properties pane for all sensor types.

Radar and lidar sensors For help information on the radar or lidar sensor properties, for example, the Configuration dialog, refer to the related radar and lidar solution documentation.

General

Enable sensor Lets you enable the sensor. When the sensor is enabled, the composition window for the sensor shows the simulation output, depending on the postprocessing that is applied. The sensor frustum is displayed in the MotionDesk 3-D view if enabled.

Sensor ID Lets you specify the sensor ID. Each sensor you add to the project must have a unique Sensor ID.

> **Note**
>
> The sensor will be downloaded only if its connection matches the currently active SensorSim connection. Therefore, you can assign specific sensors to specific PCs if you use multiple simulators.

SensorSim connections Lets you select and clear the SensorSim application instances from the list of Sensor Simulation connections you add in MotionDesk. You can select one or more connections for each sensor.

Simulation data stream Lets you select the motion data for moving the sensor. By default, the sensor moves together with the chassis so you can use its motion data.

Name Lets you specify a name for the sensor.

Sensor Position

X-offset Lets you specify the sensor position as an offset to the position specified in the motion data in the x-direction in meters.

Y-offset Lets you specify the sensor position as an offset to the position specified in the motion data in the y-direction in meters.

Z-offset Lets you specify the sensor position as an offset to the position specified in the motion data in the z-direction in meters.

Sensor Orientation

X-orientation Lets you specify the x-orientation of the sensor in relation to the orientation specified in the motion data in degrees.

Y-orientation Lets you specify the y-orientation of the sensor in relation to the orientation specified in the motion data in degrees.

Z-orientation Lets you specify the z-orientation of the sensor in relation to the orientation specified in the motion data in degrees.

Sensor Representation

Display sensor Lets you specify whether the sensor and its frustum are displayed in the 3-D View.

Sensor color Lets you specify the color of sensor in the 3-D View.

Height Lets you specify the height of the sensor in the 3-D View in meters.

Length Lets you specify the length of the sensor in the 3-D View in meters.

Width Lets you specify the width of the sensor in the 3-D View in meters.

Note

For radar sensors, the sensor Height, Length, and Width have no effect. The sensor is shown as a sphere. The Sensor color can be changed. This also changes the sensor frustum color.
Display sensor works for all sensors.

Frustum Configuration

Far color Lets you specify the color of the far lines of the frustum.

Line width Lets you specify the width of the frustum lines.

Near color Lets you specify the color of the near lines of the frustum.

Note

For radar sensors, the frustum Far color and Near color properties have no effect. The color changes when you change the Sensor Representation - Sensor color. The Line width can be changed here.

Related topics

Basics

Basics of the MotionDesk Camera and Fish-Eye Sensors.....22
Basics of the MotionDesk Laser Sensors.....70
Working with the MotionDesk Lidar Sensors (MotionDesk Lidar Sensor Module 🕮)
Working with the MotionDesk Radar Sensors (MotionDesk Radar Sensor Module 🕮)

Camera and Fish-Eye Sensor Properties

Purpose

To specify the properties of camera and fish-eye sensors for Sensor Simulation.

For properties on the MotionDesk properties pane that are common to all sensor types, refer to Common Sensor Properties on page 130.

General

For general properties common to all sensors, refer to General on page 131.

Sensor Position

For sensor position properties common to all sensors, refer to Sensor Position on page 131.

Sensor Orientation

For sensor orientation properties common to all sensors, refer to Sensor Orientation on page 131.

Sensor Resolution

Changes to the Sensor Resolution also adjust the Field of View horizontal and vertical angles. The focal length and crop factor do not change.

X-Resolution Lets you specify the width of the view for the camera sensor in pixels. The maximum value is the x-resolution of the display used for the sensor simulation composition window.

Y-Resolution Lets you specify the height of the view for the camera sensor in pixels. The maximum value is the y-resolution of the display used for the sensor simulation composition window.

Note

If a sensor does not fit into the composition window, the data is not rendered or displayed. It is also not written to the shared memory.
For large sensors, you can adjust the size of the composition window to be larger than the screen resolution. In this case, the top left portion of the sensor data is shown in the composition window. However, all data is written to shared memory.

Field of View

Horizontal Displays the horizontal field of view angle of the sensor in degrees.

For a camera sensor, the regular lens has a maximum horizontal coverage of 100 degrees. In MotionDesk, it can be a value below 180 degrees.

For a fish-eye sensor, horizontal coverage can be greater than 180 degrees. In MotionDesk, it can a value between 1 and 360 degrees.

Far clipping plane Lets you specify the furthest distance from the sensor in meters at which the lens can see objects in the scene. Objects that are beyond this far plane are not displayed. It is recommended not to adjust this value beyond 100 meters.

Near clipping plane Lets you specify the nearest distance to the sensor in meters at which the lens can see objects in the scene. Objects that are closer to the sensor than this near plane are not displayed. This value must greater than 0.1 m.

Vertical Displays the vertical field of view angle of the sensor in degrees.

Note

Field of view calculation

The horizontal and vertical field of view angle is controlled by the sensor resolution, focal length, and crop factor properties and the *Geometric Distortion Model for Rectilinear Lenses* or the *Geometric Distortion Model for Fish-eye Lenses*.

For more information, refer to Sensor Resolution.

Lens Configuration

For lens configuration and distortion properties for camera and fish-eye sensors, refer to Camera and Fish-Eye Sensor Lens Configuration Properties on page 137.

Sensor Representation

Display original camera data (Camera sensor only) Lets you specify whether the original camera data is displayed at the far end of the sensor frustum in the scene in the 3-D View.

For sensor representation properties common to all sensors, refer to Sensor Representation on page 131.

Frustum Configuration

Diameter (Fish-eye sensor only) Lets you specify the diameter of the fish-eye lens sensor frustum that is displayed in the MotionDesk 3-D animation. It does not affect the sensor composition window image. It is used to show the approximation of the image that is displayed in the composition window.

For frustum configuration properties common to all sensors, refer to Frustum Configuration on page 132.

Output Settings

The following properties lets you specify the output settings for camera and fish-eye sensors.

Exposure Let you specify the amount of light exposure for the MotionDesk sensor data. Increasing the exposure brightens the scene as detected by the sensors. The changes to the exposure can be shown in the sensor composition window. You can specify a range between 0 and 100. The default value is 1.

Gamma correction Lets you apply gamma correction to the MotionDesk scene image data displayed on a screen for over-the-air simulations.

Gamma correction is selected by default for new camera and fish-eye sensors.

Note

For raw data simulations, gamma correction must not be selected. Gamma correction is not included in raw data file formats and is unlikely to be required for raw data simulations.
It can be applied to the raw image data for on-screen formats, for example, a JPG or for the display of parking camera images.

Output mode Lets you choose between the regular RGB output and other pattern models with a higher bit depth.

Output Mode	Description	Pixel Settings
Standard RGB	The sensor output displays the pixels in standard RGB color intensity format.	Grayed out
2 × 2 Pattern 24-bit	The sensor output uses a 2 × 2 color filter array with a 24-bit intensity per pixel.	Available
2 × 2 Pattern 12-bit packed	The sensor output uses a 2 × 2 color filter array with a 12-bit intensity per pixel.	Available

If you select the **2 × 2 pattern** output modes, you can specify the colors and intensities that are encoded in each pixel of the pattern.

For more information on camera and fish-eye sensor output mode settings, refer to Basics on the Camera and Fish-Eye Output Settings (Sensor Simulation Control).

Top left pixel Displays the selected color setting of the top left pixel of a 2 × 2 pattern.

Top right pixel Displays the selected color setting of the top right pixel of a 2 × 2 pattern.

Bottom left pixel Displays the selected color setting of the bottom left pixel of a 2 × 2 pattern.

Bottom right pixel Displays the selected color setting of the bottom right pixel of a 2 × 2 pattern.

Pixel settings If you set the output to a 2 × 2 pattern, you can apply color intensities for each pixel. In the subproperties for each part of the pixel, **Top left**, **Top right**, **Bottom left**, **and Bottom right**, you can select a color coefficient setting from a list. You can also manually specify the red, green, and blue coefficients.

For example, for a Bayer pattern, you can select red for the top left part, green for the top right and bottom left, and blue for the bottom right pixel.

- **Define as**

  Select a predefined color setting or color coefficients for luminance. You can also select to manually set custom coefficients for each color:

  Select a predefined color setting from the list:

- Red
- Green
- Blue
- Luminance: Predefined red, green, and blue coefficients
- Custom coefficients: Manually set the red, green, and blue coefficients.

  Custom coefficients
  - red coeff.

    Lets you specify or displays the value of the red coefficient.
  - green coeff.

    Lets you specify or displays the value of the green coefficient.
  - blue coeff.

    Lets you specify or displays the value of the blue coefficient.

Postprocessing

The properties are used to select the library used for postprocessing and enabling postprocessing. For more information on postprocessing, refer to Postprocessing the Images of Camera and Fish-Eye Sensors on page 63.

Enabled Lets you select and clear the postprocessing effects. You must select a postprocessing file from the library path before you can enable postprocessing.

Library path Lets you select the DLL file for postprocessing effects. This file must be located in the `Plugins` folder in the 3DLibrary customer objects folder.

Output width Displays the final output width of postprocessing. The value 0 means that no postprocessing is active.

Output height Displays the final output height of postprocessing. The value 0 means that no postprocessing is active.

Related topics

Basics

Basics of the MotionDesk Camera and Fish-Eye Sensors..... 22
Basics on the Camera and Fish-Eye Output Settings..... 54

HowTos

How to Insert a Camera Sensor..... 28
How to Insert a Fish-Eye Sensor..... 30

References

Camera and Fish-Eye Sensor Lens Configuration Properties..... 137
Common Sensor Properties..... 130

Camera and Fish-Eye Sensor Lens Configuration Properties

Purpose

To specify the lens configuration and distortion properties for camera and fish-eye sensors for Sensor Simulation.

For other camera and fish-eye sensor properties, refer to Camera and Fish-Eye Sensor Properties on page 132. For properties that are common to all sensor types, refer to Common Sensor Properties on page 130.

Lens Configuration

Crop factor Lets you specify the ratio of the diagonal length of the camera image sensor compared to a standard 35 mm film format.

You divide the diagonal length of a 35 mm film (43.3 mm) by the diagonal length of the camera image sensor to calculate the lens sensor crop factor.

The field is disabled if you select a lens profile using an LCP file. In this case, the focal length and crop factor values in the lens profile are used.

Focal Length (mm) Lets you specify the focal length of the camera and fish-eye sensor in millimeters.

The field is disabled if you select a lens profile using an LCP file.. In this case the focal length and crop factor values in the lens profile are used.

The focal length of a camera lens is the measurement in millimeters between the center of the lens to the sensor chip or image plane.

Note

Field of view calculation

The horizontal and vertical field of view angle is controlled by the sensor resolution, focal length, and crop factor properties and the *Geometric Distortion Model for Rectilinear Lenses* or the *Geometric Distortion Model for Fish-eye Lenses*.

For more information, refer to the field of view properties in Camera and Fish-Eye Sensor Properties on page 132.

Lens distortion Lets you select to enable lens distortions for the camera or fish-eye sensors. You can specify lens distortions manually or load a lens correction profile file (LCP file name extension) and then select a lens setting from the profile.

Radial distortions can also be loaded from a table.

When distortions are selected or loaded, the distortions are applied to the sensor data and displayed in the sensor composition window.

Lens distortion options

- None: Lens distortions are not applied to the sensor data output. The Look-up table and Adobe distortion properties are disabled.
- Look-up table: Select Look-up table if you want to load a `look-up table` to apply radial distortions to the lens for the camera and fish-eye sensors.

The look-up table path field and description are enabled when you select **Look-up table** in lens distortion.

- **Look-up table path**: Lets you search for a file path for the look-up table that contains the definitions for the radial distortions of the sensor.

For more information on the look-up table file, refer to How to Select a Lens Distortion Look-Up Table on page 41.

- **Adobe**: Select **Adobe** to load Adobe lens correction profiles or manually set the lens distortions according to the Adobe lens correction profile model.

  The manual lens distortion properties are enabled in the properties tree when you select **Adobe** in **Lens distortion**, provided that the **lens setting** is **Manual**.

  The individual adobe lens distortions properties in the tree are detailed in the following sections.

Adobe (Lens distortion configuration)

Load lens correction profile information Lets you search for and select a lens correction profile file (LCP file name extension). The LCP files contains the lens setting definitions for the lens.

> **Note**
>
> A lens correction profile for fish-eye lenses cannot be loaded for a camera sensor and vice versa.

> **Note**
>
> You must also select **Adobe** in the **Lens distortion** property to configure lens settings from a file or to manually set the distortions. Refer to Lens distortion on page 137.

Select lens settings Lets you select from a list a specific lens settings in the lens correction profile (LCP) file that you loaded in the previous lens correction profile property.

The focal length, crop factor, field of view, and all distortions coefficient properties in the **Lens configuration** group are then disabled for manual editing.

You can also select **Manual** to manually specify the lens distortion properties.

Enable chromatic aberration Lets you enable the chromatic aberration for the camera and fish-eye sensors. Radial distortions are disabled.

Radial Distortion Coefficients

You can also specify the radial distortion coefficients manually in a Polynomial coefficient dialog.

Note

You must disable chromatic aberration to apply radial distortion properties. Refer to Enable chromatic aberration on page 138.
Radial distortion coefficients are overridden by the chromatic aberration green channel values.

Select a node to edit: Lets you select a polynomial coefficient node. You can add a node with the next exponent value in the sequence and then specify the Coefficient value to be multiplied by the exponent of the node.

Coefficient Lets you specify the polynomial coefficient factor for each node.
One of the nodes must have a coefficient factor value of greater than 0.

Exponent The power value that specifies how many times to multiply the coefficient value by itself.
This is a display field. The exponent is predefined when you add the node.

Chromatic Aberration Green Coefficients

The chromatic aberration green coefficients are read from the lens correction profile if you select a lens setting from the correction profile.For more information on the lens settings, refer to the documentation for the specific lens under test.

You can also manually enter chromatic aberration green coefficients for a camera or fish-eye sensor in a polynomial coefficient dialog.

Note

To apply chromatic aberration distortion effects, you must enable chromatic aberration. Refer to Enable chromatic aberration on page 138.

Polynomial coefficient Lets you add a polynomial coefficient node with the next exponent value in the sequence. You then specify the Coefficient to be multiplied by the Exponent of the node.
For information on the Polynomial coefficient dialog, refer to radial distortion coefficients. (refer to Select a node to edit: on page 139)

Chromatic Aberration Green/Blue Coefficients

The chromatic aberration green/blue coefficients are read from the lens correction profile if you select a lens setting from the correction profile.For more information on the lens settings, refer to the documentation for the specific lens under test.

You can also manually enter chromatic aberration green/blue coefficients for a camera or fish-eye sensor.

Note

To apply chromatic aberration distortion effects, you must enable chromatic aberration. Refer to Enable chromatic aberration on page 138.

cbg0 Lets you specify the chromatic aberration blue/green coefficient cbg_0.

cbg1 Lets you specify the chromatic aberration blue/green coefficient cbg_1.

cbg2 Lets you specify the chromatic aberration blue/green coefficient cbg_2.

cbg3 Lets you specify the chromatic aberration blue/green coefficient cbg_3.

Note

For more information on the Adobe lens distortions coefficients, refer to the Adobe Camera Model Version 1.0 by Adobe Systems.

Chromatic Aberration Green/Red Coefficients

The chromatic aberration green/red coefficients are read from the lens correction profile if you select a lens setting from the correction profile. For more information on the lens settings, refer to the documentation for the specific lens under test.

You can also manually enter chromatic aberration green/red coefficients for a camera or fish-eye sensor.

Note

To apply chromatic aberration distortion effects, you must enable chromatic aberration. Refer to Enable chromatic aberration on page 138.

cgr0 Lets you specify the chromatic aberration green/red coefficient cgr_0.

cgr1 Lets you specify the chromatic aberration green/red coefficient cgr_1.

cgr2 Lets you specify the chromatic aberration green/red coefficient cgr_2.

cgr3 Lets you specify the chromatic aberration green/red coefficient cgr_3.

Note

For more information on the Adobe lens distortions coefficients, refer to the Adobe Camera Model Version 1.0 by Adobe Systems.

Vignette Coefficients

The vignette coefficients are read from the lens correction profile if you select a lens setting from the correction profile.For more information on the lens settings, refer to the documentation for the specific lens under test.

You can also manually enter vignette coefficients for a camera or fish-eye sensor.

v1 Lets you specify the vignette coefficient v_1.

v2 Lets you specify the vignette coefficient v_2.

v3 Lets you specify the vignette coefficient v_3.

Note

For more information on the Adobe lens distortions coefficients, refer to the Adobe Camera Model Version 1.0 by Adobe Systems.

Related topics

Basics

Working with Adobe Lens Radial Distortions.....48

HowTos

How to Load an Adobe Lens Correction Profile.....44
How to Manually Specify Adobe Lens Distortions.....46
How to Select a Lens Distortion Look-Up Table.....41

References

Camera and Fish-Eye Sensor Properties.....132
Common Sensor Properties.....130

Laser Sensor Properties

Purpose

To specify the properties of a laser sensor for Sensor Simulation. The properties are specific to the laser sensors. For properties on the properties pane that are common to all sensors, refer to Common Sensor Properties on page 130.

General

For general properties common to all sensors, refer to General on page 131.

Sensor configuration

Horizontal angular resolution (°) Lets you specify the horizontal angular resolution in degrees.

Update rate (Hz) Lets you specify the update rate of the sensor in Hertz.

Vertical number of lasers Lets you specify the vertical number of lasers.

Field of View	**Horizontal** Lets you specify the horizontal field of view of the sensor in degrees. **Far point** Lets you specify the far point of a laser sensor in meters. This is the farthest point the laser can reach. **Near point** Lets you specify the near point of a laser in meters. This is the closest point at which the laser operates. **Vertical** Lets you specify the vertical field of view of the sensor in degrees.
Sensor Position	For sensor position properties common to all sensors, refer to Sensor Position on page 131.
Sensor Orientation	For sensor orientation properties common to all sensors, refer to Sensor Orientation on page 131.
Output mode	**Azimuth angle** Lets you select the azimuth angle output mode of the scene and simulation. If an object is detected by a ray of the laser sensor, the azimuth angle of the object is encoded into the corresponding pixel in the composition window. **Depth** Lets you select the Depth output mode of the scene and simulation. If an object is detected by a ray of the laser sensor, the depth of the object is encoded into the corresponding pixel in the composition window. **Distance** Lets you select the Distance output mode of the scene and simulation. If an object is detected by a ray of the laser sensor, the distance to the object is encoded into the corresponding pixel in the composition window. **Elevation angle** Lets you select the Elevation angle output mode of the scene and simulation. If an object is detected by a ray of the laser sensor, the elevation angle to the object is encoded into the corresponding pixel in the composition window. **Material ID** Lets you select the Material ID output mode of the scene and simulation. When the sensor detects an object with a material ID, the material ID is encoded into the corresponding pixel of the sensor output. Laser sensors display the material ID colors between 0 and 2^{24-1} encoded in RGB.

For example, 258 is encoded as Red 0, Green 1, and Blue 2. All indices below 256 will have a red and green value set to zero.

Normal vector Lets you select the Normal vector output mode of the scene and simulation. If an object is detected by a ray of the laser sensor, the normal vector of the object is encoded into the corresponding pixel in the composition window.

Relative velocity Lets you select the Relative velocity output mode of the scene and simulation. If an object is detected by a ray of the laser sensor, the relative velocity of the object is encoded into the corresponding pixel in the composition window.

Visualization

Color mode Lets you specify how the visualization points are colored.

Display point cloud Lets you specify whether the point cloud visualization is enabled or not.

High color Lets you specify the high color of the visualization points.

Infinity color Lets you specify the color in the output for the laser rays that do not detect an object.

Low color Lets you specify the low color of the visualization points.

Point size Lets you specify the size of the visualization points.

Show infinity points Lets you specify whether to display sensor points that do not hit any target.

Sensor Representation

For sensor representation properties common to all sensors, refer to Sensor Representation on page 131.

Frustum Configuration

For frustum configuration properties common to all sensors, refer to Frustum Configuration on page 132.

Related topics

Basics

Basics of the MotionDesk Laser Sensors 70

HowTos

How to Change the Basic Laser Sensor Properties 75
How to Change the Laser Sensor Output Mode 78
How to Insert a Laser Sensor 73

References

Common Sensor Properties 130

Radar Sensor Properties

Purpose

To specify the properties of a radar sensor for Sensor Simulation. The properties detailed are specific to the radar sensors. For more information, refer to **Radar Sensor Properties (Radar Sensor Module)**.

For properties on the properties pane that are common to all sensors, refer to Common Sensor Properties on page 130.

Note

Radar sensor module

To create radar sensors with MotionDesk to use with Sensor Simulation, you must install the Radar Sensor Module add-in and the required licenses from dSPACE. The documentation for Radar Sensor Module is included in the installation package.

For more information, contact your local dSPACE representative.

Related topics

References

Common Sensor Properties..... 130

Lidar Sensor Properties

Purpose

To specify the properties of a lidar sensor for Sensor Simulation. The properties detailed are specific to the lidar sensors. For more information, refer to **Lidar Sensor Properties (Lidar Sensor Module)**.

For properties on the properties pane that are common to all sensors, refer to Common Sensor Properties on page 130.

Note

Lidar sensor module

To create lidar sensors with MotionDesk that can be used with Sensor Simulation, you must install the Lidar Sensor Module and the sensor module license from dSPACE. The documentation for Lidar Sensor Module is included in the installation package.

For more information, contact your local dSPACE representative.

Related topics

References

Common Sensor Properties..... 130

Material Manager Commands

Introduction

MotionDesk provides a dialog for adding, removing, and editing materials for sensor simulation.

Where to go from here

Information in this section

Material Database Editor 146
To start the Material Database Editor.

Materials 147
To search and select materials in the browser to edit their properties.

Manage Extended Properties 149
To add, remove, and edit the name and default values of the extended properties that are assigned to the materials in the database.

Save 151
To save all changes to the materials and extended properties.

Close 151
To close the Material Database Editor.

Help 152
To open MotionDesk online help in dSPACE Help and get context-sensitive help for a button, command, or window in the Material Database Editor.

Material Database Editor

Access

You can access this command via:

Ribbon	Home – Materials
Context menu of	None
Shortcut key	None
Icon	

Purpose

To start the Material Database Editor.

Description

Using the Material Database Editor, you can add, remove, and edit materials and extended properties.

Related topics

Basics

Overview of Material Management (Sensor Simulation Manual 🕮)

Materials

Access

You can access the **Materials** pane via:

Ribbon	**Material Database Editor – Materials**
Context menu of	None
Shortcut key	None
Icon	None
Window	Material Database Editor on page 146

Purpose

To search and select materials to edit their properties.

Result

Materials are found and selected for further actions.

Materials pane functions

The materials tab provides the below functions:

Search A search reduces the number of materials that are displayed in the dSPACE Materials and Custom Materials trees based on the string entered in the Search field:

Additional Filter Elements	Description
Search field	Lets you enter the search string. You can enter alpha-numeric characters.
🔍	Click the magnifying glass to search for the search string in the name and ID of the materials.
×	Click to clear the search string and display all materials.

Materials tree The tree displays the full list of materials in the material database.

Additional Filter Elements	Description
dSPACE Materials	The expandable dSPACE material list shows all materials in the material database delivered by dSPACE.

Additional Filter Elements	Description
Custom Materials	The expandable custom material list shows all the custom materials in the material database.

Add Material The Add Material button lets you add a new material to the custom material database.

A new material with the name Material0 is added to the Custom Materials tree. For example, if you add a new material before you rename Material0, the next material is added with the name Material1.

The MotionDesk Material Database Editor applies the next available number in the sequence for the material ID.

You can also right-click the Custom Material node and select Add Custom Material on the context menu.

Remove Material The Remove Material button lets you remove an existing material from the custom material database.

Note

You cannot remove dSPACE materials.

You must click Save to complete the removal.

You can also right-click the material and select Remove Material on the context menu.

Note

You can remove custom materials only one at a time.

Related topics

HowTos

How to Add and Edit a Custom Material..... 101
How to Remove a Custom Material..... 106

References

Manage Extended Properties..... 149
Material Database Editor..... 146

Manage Extended Properties

Access

You can access the **Manage Extended Properties** pane via:

Ribbon	**Material Database Editor – Manage Extended Properties**
Context menu of	None
Shortcut key	None
Icon	None
Window	Material Database Editor on page 146

Purpose

To add, remove, and edit the name and default values of the extended properties that are assigned to the materials in the database.

Result

Extended properties are added and edited and are assigned to the materials in the database.

Manage Extended Properties

The **Manage Extended Properties** pane provides the following functions:

Add property In the table in the **Manage Extended Properties** pane, type a property name and a default value in a new empty row.

Then select + to add the new property to the database and apply the extended property and its default value to all existing dSPACE and custom materials.

Additional Filter Elements	Description
Property name	Lets you enter and edit the property name of the extended property. The name must be unique among existing extended properties. The name must contain only letters, numbers, and underscores. White spaces are not permitted.
Property type	Lets you select the property type for **Default value** and material **Value** fields. Property type ▪ **Int**: The integer type lets you specify a numerical value. ▪ **Double**: The double type lets you specify a numerical value with a decimal point. ▪ **String**: The string type lets you specify an alpha-numerical value. You must select a property type from the list. You cannot change the property type after the extended property is added.

Additional Filter Elements	Description
Default value	Lets you enter and edit the default value of the extended property. The default value must meet the requirements of the property type. For example, only numerical characters and one decimal point or comma are permitted for the double property type.

The extended property is saved to the database when you click **Save**.

Note

If you change the default value for an extended property in the **Manage Extended Properties** pane, the actual value for the extended property is not changed for the existing materials in the **Materials** pane.

Remove property In the **Manage Extended Properties** pane, select × for an existing extended property.

The row is removed from the table and the extended property is removed from all existing dSPACE and custom materials.

The removal of the extended property is confirmed when you click **Save**.

Note

You can remove any extended property. The property is removed from all materials in the database, including materials where the default value of the extended property was changed.

For information on the material properties, refer to Material Properties on page 153.

Related topics

HowTos

How to Add and Edit a Material Extended Property..... 104
How to Remove an Extended Material Property..... 108

References

Material Database Editor..... 146
Materials..... 147

Save

Access

You can access this command in the material database editor via:

Menu bar	None
Context menu of	None
Shortcut key	None
Icon	None
Button	Save

Purpose

To save all changes to the materials and extended properties.

Result

The changes to the materials and extended properties are saved.

Related topics

HowTos

How to Add and Edit a Custom Material..... 101

Close

Access

You can access this command in the Material Database Editor via:

Menu bar	None
Context menu of	None
Shortcut key	None
Icon	×
Button	None

Purpose

To close the Material Database Editor.

Note

If there are unsaved changes, a warning message is displayed to ask if you want to save the changes.

Result

The Material Database Editor closes.

Related topics

HowTos

How to Add and Edit a Custom Material..... 101

Help

Access

You can access this command via:

Menu bar	None
Context menu of	None
Shortcut key	**F1**
Icon	None
Button	Help
Property field help link	Link

Purpose

To open MotionDesk online help in dSPACE Help and get context-sensitive help for a button, command, or window in the material manager editor.

Result

The online help for the selected item opens.

Related topics

HowTos

How to Add and Edit a Custom Material..... 101
How to Add and Edit a Material Extended Property..... 104

References

Manage Extended Properties..... 149
Material Properties..... 153
Materials..... 147

Material Manager Properties

Introduction

MotionDesk provides a properties pane for editing the properties of the materials in the database for sensor simulation.

Material Properties

Purpose

To specify properties for the materials in the material database.

Description

The material properties are displayed in the Properties pane when you select a material in the dSPACE or custom materials tree. You can change the values of the properties for custom materials. For dSPACE materials, you can only change the preview color and extended property values.

Mandatory properties

The following properties must be added.

ID

- dSPACE materials: The ID is assigned by MotionDesk and cannot be changed. The field is read-only.

  Note

  The ID values `1` to `15999` are reserved for dSPACE materials

- Custom materials: When you add a new material, the material is added under the custom material tree with the next available ID in the sequence.

  You can change the ID. A warning is displayed if you change the ID to a number used by another material or to a number reserved for dSPACE materials.

  Note

  The ID values `16001` to `31999` are available for custom materials.
  The material ID must contain only numbers in this range.

Name

- dSPACE materials: The name is assigned by MotionDesk and cannot be changed. The field is read-only.
- Custom materials: You can change the name of the custom materials.

  The name must not be empty and must be unique among dSPACE and custom materials. A warning is displayed if you change the name to a name used by another dSPACE or custom material.

Note

The material name must contain only letters, numbers, and underscores. Whitespaces are not permitted.

Preview color Lets you change the preview color for the dSPACE and custom materials. The color does not have to be unique.

Click the color or arrow icon to show the color selector pane. You can select the color by moving the cursor icon or slider on the color pallet, select a recently used color, or manually enter the RGB values or the hexadecimal code.

The preview color is shown in the **3-D View** when you select a view that is configured to show the material ID preview. For more information, refer to How to Display the Material ID Preview in MotionDesk (MotionDesk Scene Animation 🕮).

The material output preview for sensors can be selected and displayed in the composition window. For an example of a laser sensor material ID preview output, refer to How to Change the Laser Sensor Output Mode on page 78.

Note

Copy property value

Right-click on the property ID, name, or extended property name to copy the value. You can paste the value into the search field.

Extended properties

Displays a table showing all the extended properties and their values.

Name This is a display field that shows the name of each extended property you added. You cannot change the name in the properties pane.

All extended properties in the database are displayed for all materials.

Value Lets you change the value of the extended property for the selected material.

The default value must meet the requirements of the property type. For example, only numerical characters and one decimal point or comma are permitted for the double property type.

Note

If you change the default value for an extended property in the **Manage Extended Properties** pane, the actual value of the extended property for the existing materials does not change.

Value type This is a display field that shows the property type for the extended property value. You cannot change the property type for an existing extended property.

For information on the extended properties, refer to Manage Extended Properties on page 149.

Properties menu bar functions

Menu options The Properties pane displays the available filtered/unfiltered properties. You can use the following icons to filter and order the properties.

Icon	Description
	Shows the property categories in order and fully expanded.
	Shows all properties in a hierarchical order and fully expanded.
	Collapses all properties and property categories.
Search properties	Lets you enter text to search for a specific property.
	Lets you select the search criteria.
	Jumps to the next match in the search results.
	Jumps to the previous match in the search results.
	Lets you use filters to show only the properties that match the search results.

Related topics

HowTos

How to Add and Edit a Custom Material..... 101
How to Remove a Custom Material..... 106

References

Manage Extended Properties..... 149
Materials..... 147

Troubleshooting (Material Database Editor)

Introduction

You can troubleshoot errors that occur when using the Material Database Editor.

Where to go from here

Information in this section

Cannot Open the Material Database Editor..... 158
An error message is displayed when you open the Material Database Editor.

Warning When Merging the MaterialMapping.xml..... 159
An error message is displayed when you start MotionDesk and select to merge the material database.

Warning When Changing Material ID or Name..... 160
A warning message is displayed when you change the material ID, material name, or extended property name.

Cannot Add or Remove a dSPACE Material..... 161
You cannot remove a dSPACE material.

Recover a Removed Custom Material or Extended Property..... 161
You want to recover a removed a custom material or extended property.

Cannot Remove an Extended Property from a Material..... 162
You cannot remove an extended property from a material.

Cannot Change the Default Value of an Extended Property for All Materials..... 162
You changed the default value of an extended property but it does not change the actual value for the existing materials.

Cannot Open the Material Database Editor

Problem

An error message is displayed when you open the Material Database Editor.

```
The Material Database Editor cannot be started. The
MaterialMapping.xml material database file cannot be loaded.
```

Reason

The `MaterialMapping.xml` file is missing from your custom object library or is corrupted and cannot be opened by the Material Database Editor.

Solution

Restart MotionDesk Close and restart MotionDesk.

The `MaterialMapping.xml` file is copied from the installation folder to your custom object library, for example:

`%CUSTOM_OBJECT_LIBRARY%\MaterialManagement`.

Tip

For information on the location of the custom objects library, refer to How to Change the Location of the Custom Objects Library (MotionDesk Custom Object Library Management 🕮).

Manually copy the MaterialMapping.xml to your custom library Copy the `MaterialMapping.xml` material database file from the installation folder to your custom object library. For example, copy the file from:

`<MotionDesk_InstallationPath>\MotionDesk\Assets\Materials` to:

`%CUSTOM_OBJECT_LIBRARY%\MaterialManagement`.

If a `MaterialMapping.xml` material database file exists in the folder, you must rename this file.

Tip

You can also rename a previously backed up material database file to `MaterialMapping.xml`.

Note

The `MaterialMapping.xml` file you copied from the installation folder is a clean database. You must add all custom materials and extended properties using the MotionDesk Material Database Editor again.

Related topics

HowTos

How to Change the Location of the Custom Objects Library (MotionDesk Custom Object Library Management 🕮)
How to Merge the Material Database 96

Warning When Merging the MaterialMapping.xml

Problem

An error message is displayed when you start MotionDesk and select to merge the material database.

A warning message is also displayed in the **Messages** pane that the merge has failed.

Reason

A merge can occur if you previously manually renamed or changed the ID of dSPACE materials. You might also have manually added new materials using the reserved dSPACE material ID range.

There is a merge conflict with the new version of the `MaterialMapping.xml` when you start MotionDesk.

⚠ CAUTION

You must use the **Material Database Editor** in MotionDesk to manage custom materials and material characteristics. If you manually edit the `MaterialMapping.xml` material database errors can occur when using the editor and the materials.

Solution

Manually copy the MaterialMapping.xml to the custom library When the merge fails, a log file is created and warnings are displayed in the **Messages** pane. The material names, IDs, and preview colors that could not be merged are displayed.

You must manually copy the `MaterialMapping.xml` from the install directory to the custom object library folder. You then use the Material Database Editor to re-add your custom materials and extended properties.

Note

It is not recommended to open the `MaterialMapping.xml` file in an XML editor and manually add the materials that failed to merge. This can result in errors when using the materials and the Material Database Editor.

Related topics

HowTos

How to Merge the Material Database.....96

References

Material Database (Sensor Simulation Manual 🕮)

Warning When Changing Material ID or Name

Problem

A warning message is displayed when you change the material ID, material name, or extended property name.

Reason

Changes to the dSPACE material ID, material name, or extended property name are restricted.

Solution

The following table lists solutions to the respective warnings:

Warning	Cause	Solution
The material ID is not within the allowed range.	You changed the material ID to a new low ID number.	**Change the ID to a value within the allowed range** You must select a material ID for custom materials in the range between 16001 and 31999. You can use the suggested value provided in the warning message. Numbers below 16001 are reserved for dSPACE materials.
Material with ID "x" exists.	You changed the material ID to a new ID number which is already used by a custom material.	**Change the ID to a unique value** The material ID of each material must be unique. Select **OK** and enter the value suggested in the warning message. You can also enter an alternative value. The next available number might be a lower number if you previously skipped numbers in the sequence.
Material with name "x" already exists	You added a new material name that is already used by a custom material.	**Change the name to a unique value** The material name exists as a custom or dSPACE material. You must type an alternative value.
The material name contains invalid characters.	You added a new material name with invalid characters.	**Remove invalid characters from the material name** The material name must contain only letters, numbers, and underscores. You must remove the invalid characters. Whitespaces are not permitted.
Extended Property with name "x" already exists.	You added a new extended property name that is already used by an extended property.	**Change the property name to a unique value** The extended property name already exists. You must enter an alternative value.

Related topics

HowTos

How to Add and Edit a Custom Material..... 101

Cannot Add or Remove a dSPACE Material

Problem

You cannot remove a dSPACE material.

Reason

You cannot add or remove dSPACE materials. dSPACE materials are provided in the `MaterialMapping.xml` material database file and merged into your custom library when you start MotionDesk.

You can add and remove only custom materials.

Related topics

HowTos

How to Add and Edit a Custom Material..... 101

Recover a Removed Custom Material or Extended Property

Problem

You want to recover a removed a custom material or extended property.

Solution

Recover a removed custom material or extended property Close the dialog without saving the changes by clicking X. Open the editor again.

If you saved the changes, you must add the material or properties again manually.

Related topics

HowTos

How to Add and Edit a Custom Material..... 101
How to Add and Edit a Material Extended Property..... 104
How to Remove a Custom Material..... 106
How to Remove an Extended Material Property..... 108

Cannot Remove an Extended Property from a Material

Problem

You cannot remove an extended property from a material.

Reason

You can only remove the extended property from all materials.

Solution

Remove the extended property. This removes the property from all materials in the database. You can then add the extended property again with a new default value for all materials.

Related topics

HowTos

How to Add and Edit a Material Extended Property..... 104
How to Remove an Extended Material Property..... 108

Cannot Change the Default Value of an Extended Property for All Materials

Problem

You changed the default value of an extended property but it does not change the actual value for the existing materials.

Reason

When you add and save an extended property with a default value, it is added to all dSPACE and custom materials in the database.

When you change the default value of an extended property, the new value is used by all materials you add afterwards.

The value of the existing materials does not change. This ensures that any changes you make to the default values for specific materials are not overwritten.

Solution

Change the property value for each material You can change the extended property value individually for each existing material in the Materials pane.

Remove and re-add the extended property with a new default value You can remove the extended property and add it again with a new default value.

The extended property with the new default value is applied to all materials in the database.

Note

When you remove an extended property, it is removed from all materials including the materials whose default value you adjusted.

Related topics

HowTos

How to Add and Edit a Material Extended Property..... 104
How to Merge the Material Database..... 96
How to Remove an Extended Material Property..... 108
How to Search for a Material..... 98

Automation

Where to go from here

Information in this section

Sensor Simulation Tool Automation..... 166

Classes for Sensor Simulation Control..... 167

Information in other sections

Introduction to the MotionDesk Automation Interface (MotionDesk Automation 🕮)
Introduces the MotionDesk automation interface and the required user experience.

Features of MotionDesk Automation Interface (MotionDesk Automation 🕮)
Describes the features of the MotionDesk automation interface.

Overview of the Object Model (MotionDesk Automation 🕮)
Shows you the object dependencies, object attributes and methods in the MotionDesk object model at a glance.

Example of Automating MotionDesk with a Python Script (MotionDesk Automation 🕮)
Code examples demonstrate how you can automate MotionDesk with a Python script.

Sensor Simulation Tool Automation

Using Automation for Sensor Simulation Control

Introduction

You can use the MotionDesk automation interface to support Sensor Simulation.

Sensor Simulation automation

The MotionDesk automation interface supports the following Sensor Simulation features:

- SensorSim connections
  - Outputs the number of SensorSim application instance connections and their status
  - Download of the current scene to the running application instances that were started by MotionDesk
  - Enabling or disabling all or specific SensorSim application instances.
- Sensors
  - Output the number, name and status of sensors in the scene
  - Enable or disable the sensors in the loaded scene
  - Assign the sensors to SensorSim application instances.

MotionDesk automations allows you to control MotionDesk with scripts, for example with the Python programming language. The interface contains several classes that you can use in your scripts.

Related topics

References

Overview of the Object Model (MotionDesk Automation 🕮)

Classes for Sensor Simulation Control

Introduction

The following topics provides a description of the classes that you can use for automating the control of the SensorSim application in MotionDesk and downloading a scene to the running application instances.

Where to go from here

Information in this section

ConnectionManager 167
To get the sensor simulation application instance connections.

SensorSimConnections 168
To get the sensor simulation application instance connections for downloading the scene and start or stop all connections.

SensorSimConnection 172
To access a sensor simulation application instance connection for getting the name of the connection and start or stop the connection.

Sensors 174
To access the sensors in a MotionDesk scene.

Sensor 176
To access a sensor in a MotionDesk scene.

ConnectionManager

Purpose

To get the sensor simulation application instance connections.

Class Description (ConnectionManager)

Syntax

```
ConnectionManager = Application.ConnectionManagement
```

Purpose

To get the sensor simulation application instance connections.

Attributes

The class contains the following attributes:

Attributes	Type	Purpose
SensorSimConnections	SensorSimConnections[1)]	To access the collection of sensor simulation application instance connections.

[1)] Refer to SensorSimConnections on page 168.

Methods

-

Related topics

References

Application (MotionDesk Basics 🕮)

SensorSimConnections

Purpose

To get the sensor simulation application instance connections for downloading the scene and start or stop all connections.

Where to go from here

Information in this section

Class Description (SensorSimConnections)..... 169
To describe the class and its attributes.

DownloadScene..... 170
To trigger the scene download to all the running active SensorSim application instances.

Item..... 170
To access a SensorSim application instance connection.

StartConnections..... 171
To start all the SensorSim application instance connections.

StopConnections..... 171
To stop all the SensorSim application instance connections.

Class Description (SensorSimConnections)

Syntax

```
SensorSimConnections = ConnectionManagement.SensorSimConnections
```

Purpose

To get the collection of all SensorSim application instances in the MotionDesk connections dialog for downloading the scene and start or stop all connections.

Description

You access the methods and properties to return the list of all SensorSim application instances that are stored in the MotionDesk connections dialog using the name and index functions. This includes those instances that are started and stopped.

You can also start and stop the connections and trigger the download of the active MotionDesk scene to the running SensorSim application instances.

Attributes

The class contains the following attributes:

Attributes	Type	Purpose
Count	integer	To get the number of the connections in the MotionDesk connections dialog.

Methods

The class contains the following methods:

Attributes	Purpose
DownloadScene	To trigger the scene download to all the running active SensorSim application instances. Refer to DownloadScene on page 170.
Item	To access a SensorSim application instance connection. Refer to Item on page 170.
StartConnections	To start all the SensorSim application instance connections. Refer to StartConnections on page 171.
StopConnections	To stop all the SensorSim application instance connections. Refer to StopConnections on page 171.

Related topics

References

ConnectionManager..... 167

DownloadScene

Class

SensorSimConnections

Syntax

```
RetVal = SensorSimConnections.DownloadScene()
```

Purpose

To trigger the scene download to all the running active SensorSim application instances.

Parameters

-

Return value

The method returns the following parameter:

Attributes	Purpose
Boolean	`True` if download to all instances were successful. `False` if unsuccessful.

Related topics

References

Class Description (SensorSimConnections)..... 169

Item

Class

SensorSimConnections

Syntax

```
SensorSimConnection = SensorSimConnections.Item(connectionIdentifier)
```

Purpose

To access a SensorSim application instance connection.

Parameter

The class contains the following attributes:

Parameter	Type	Purpose
connectionIdentifier	object	Identifier of the connection. The identifier can be specified as string (connection name) or integer (index).

Return value

The method returns the following parameter:

Type	Description
SensorSimConnection[1)]	The specific SensorSim application instance connection.

[1)] Refer to SensorSimConnection on page 172.

Related topics

References

Class Description (SensorSimConnections)..... 169

StartConnections

Class

SensorSimConnections

Syntax

```
SensorSimConnections.StartConnections()
```

Purpose

To start all the SensorSim application instance connections.

Parameter

-

Return value

-

Related topics

References

Class Description (SensorSimConnections)..... 169

StopConnections

Class

SensorSimConnections

Syntax

```
SensorSimConnections.StopConnections()
```

Purpose	To stop all the SensorSim application instance connections.
Parameters	-
Return value	-
Related topics	References Class Description (SensorSimConnections)..... 169

SensorSimConnection

Purpose	To access a sensor simulation application instance connection for getting the name of the connection and start or stop the connection.
Where to go from here	Information in this section Class Description (SensorSimConnection)..... 172 To describe the class and its attributes. Start..... 173 To start the SensorSim application instance. Stop..... 174 To stop the SensorSim application instance connection.

Class Description (SensorSimConnection)

Syntax	`SensorSimConnection = SensorSimConnections.Item(connectionIdentifier)`
Purpose	To access a sensor simulation application instance connection for getting the name of the connection and start or stop the connection.

Attributes

The class contains the following attributes:

Attributes	Type	Purpose
Name	String	To get the name of the SensorSim application instance connection.

Methods

The class contains the following methods:

Method	Purpose
Start	To start the SensorSim application instance. Refer to Start on page 173.
Stop	To stop the SensorSim application instance. Refer to Stop on page 174.

Related topics

References

SensorSimConnections..... 168

Start

Class

SensorSimConnection

Syntax

```
SensorSimConnection.Start()
```

Purpose

To start the SensorSim application instance connection.

Parameter

-

Return value

-

Related topics

References

Class Description (SensorSimConnection)..... 172

Stop

Class	SensorSimConnection
Syntax	`SensorSimConnection.Stop()`
Purpose	To stop the SensorSim application instance connection.
Parameter	-
Return value	-
Related topics	References Class Description (SensorSimConnection)..... 172

Sensors

Purpose	To access the sensors in a MotionDesk scene.
Where to go from here	Information in this section Class Description (Sensors)..... 174 To describe the class and its attributes. Item..... 175 To access a sensor in the active MotionDesk scene.

Class Description (Sensors)

Syntax	`Sensors = VisualizationManager.Sensors`

Purpose

To get the collection of all sensors in the active MotionDesk experiment scene.

Attributes

The class contains the following attributes:

Attributes	Type	Purpose
Count	integer	To gets the number of sensors in the MotionDesk scene.

Methods

The class contains the following methods:

Attributes	Purpose
Item	To access a sensor in the active MotionDesk scene. Refer to Item on page 175.

Related topics

References

VisualizationManager (MotionDesk Scene Animation 🕮)

Item

Class

Sensors

Syntax

```
Sensor = Sensors.Item(sensorIdentifier, identifierType)
```

Purpose

To access a sensor in the active MotionDesk scene.

Parameter

The class contains the following attributes:

Parameter	Type	Purpose
sensorIdentifier	object	Identifier of the sensor. The identifier can be specified as different types, refer to the `identifierType`.

Parameter	Type	Purpose
identifierType	SensorIdentifierTypes	Specifies type that you use as `sensorIdentifier`. The following types are defined: ▪ `BySensorID`: The `sensorIdentifier` is the Sensor ID that you have specified in the properties. ▪ `BySensorIndex`: The `sensorIdentifier` is the index in the collection. ▪ `BySensorName`: The `sensorIdentifier` is the sensor name.

Return value

The method returns the following parameter:

Type	Description
Sensor	The specific sensor. Refer to Sensor on page 176.

Example

The following example shows how to access a specific sensor. The `MdApp` and `MyExperiment` objects are created as described in Example of Automating MotionDesk with a Python Script (MotionDesk Automation 🕮).

```
import dspace.com
Enums = dspace.com.Enums(MdApp)

MySensors = MyExperiment.VisualizationManagement.Sensors

# To access the first sensor of the collection
Sensor = MySensors.Item(0,Enums.SensorIdentifierTypes.BySensorIndex)

# To access the sensor that has sensor ID 3
Sensor = MySensors.Item(3,Enums.SensorIdentifierTypes.BySensorID)

# To access the sensor that has the name 'MySensor'
Sensor = MySensors.Item('MySensor',Enums.SensorIdentifierTypes.BySensorName)
```

Related topics

Basics

Class Description (Sensors)..... 174

Sensor

Purpose

To access a sensor in a MotionDesk scene.

Class Description (Sensor)

Syntax

```
Sensor = Sensors.Item(sensorIdentifier, identifierType)
```

Purpose

To access a sensor in the active MotionDesk experiment scene.

Description

You can set the attributes to modify the sensor name, enable or disable the sensor, and assign the sensor to SensorSim application instances.

Attributes

The class contains the following attributes:

Attributes	Type	Purpose
Name	String	To get/set the name of the sensor in the MotionDesk scene.
Enabled	Boolean	To get/set the status of the sensor. ▪ `False`: The sensor is disabled. ▪ `True`: The sensor is enabled.
SensorSimConnections	string	To get/set the list of all of the SensorSim application instances that the sensor is assigned to.
SimulationDataStream	string	To get/set the simulation data stream that is assigned to the sensor.
SensorID	string	To get/set the sensor ID for the sensor.
XOffset	double	To get/set the x-axis position offset of the sensor from the original position that is defined by the simulation data stream.
YOffset	double	To get/set the y-axis position offset of the sensor from the original position that is defined by the simulation data stream.
ZOffset	double	To get/set the z-axis position offset of the sensor from the original position that is defined by the simulation data stream.
XOrientation	double	To get/set the x-axis orientation of the sensor.
YOrientation	double	To get/set the y-axis orientation of the sensor.
ZOrientation	double	To get/set the z-axis orientation of the sensor.

Methods

-

Example

The following example shows how you can assign sensors to SensorSim connections.

```
from win32com.client import Dispatch
Application = Dispatch("MotionDesk.Application")
# Gets the SensorSim connections defined in MotionDesk
senSimConnections = Application.ConnectionManagement.SensorSimConnections
# Start each connection
# Alternatively you can use senSimConnections.StartConnections()
for i in range(senSimConnections.Count):
    senSimConnections.Item(i).Start()

# Get the sensor collection from the active experiment in MotionDesk
MyExperiment = Application.ActiveProject.ActiveExperiment
sensors = MyExperiment.VisualizationManagement.Sensors
for j in range(sensors.Count):
    # Assign the sensor to a SensorSim connection
    # assuming Sensors.Count == SensorSimConnections.Count
    sensors.Item(j, 1).SensorSimConnections = "Connection_"+ str(j + 1)
    # Enable each sensor in the list
    sensors.Item(j, 1).Enabled = True
# Download the scene to all the instances
senSimConnections.DownloadScene()
# You can stop all the instances
senSimConnections.StopConnections()
sensors = None
senSimConnections = None
MyExperiment = None
Application = None
```

Related topics

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Sensors 174

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