

# BikeSim 2023.0 New Features

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This document lists notable new features in BikeSim version 2023.0.

## VS Solver Architecture

### VS Commands

Several new commands were added, and the effects of some existing commands were changed.

1. The `DEFINE_OUTPUT` command was improved to work more effectively. `SET_OUTPUT_SHORT_NAME` was added to allow the manual creation of short (ERD compatible) output names by the user.
2. The `RETURN` command used in defined functions was improved to reduce problems. `DEFINE_LOCAL` was improved to eliminate option of indexed local variables.
3. Error checking was added for lengths of new variables and parameters. The name lengths were extended to 48 characters; longer names now generate error messages.

### Echo Files

The display of information in Echo files generated for each simulation has been extended to indicate which parameters or table properties have been assigned values by reading from file, as opposed to those that keep default values. Some changes in this release are:

1. The convention for identifying a parameter whose value was not specified by any of the input files is to prefix the description with `[D]` (default). This has been extended to include properties of Configurable Functions.

2. A parameter `OPT_ECHO_DEFAULT` can disable the display of the `[D]` prefix, which is sometimes helpful when monitoring differences in Echo files. Another option has been added, in which the Echo file shows only parameters and Configurable Function properties that were specified in input Parsfiles. These files are much shorter and can be convenient for some applications involving automation and large numbers of runs.

## Other Improvements

1. All error messages were reviewed; many were updated to provide more specific information about the cause of the error.
2. New VS API functions were added to provide a location in the equations of the model for import and output variables; these are described in the API Reference Manual in the VS software development kit (SDK). C examples in the SDK demonstrate the new functions.

## VS Math Models

### VS Tire Tester

For external tires, VS Tire Tester iteratively solves for the wheel center height needed to produce the requested tire vertical force. Beginning in version 2023.0, the maximum number of allowed iterations, as well as the solution tolerance, may be adjusted with the math model keywords `TT_MAX_ITERATIONS` and `TT_TOLERANCE_FZ`, respectively. The default values of 1000 iterations and 1.0 N are consistent with the calculations of previous versions.

### Advancing the Interface to External Tire Models

In past versions, VS Math Models connected to external tire models one tire at a time to get forces and moments of each tire. Some third-party tire models support parallelized calculation of all tires. The VS Solver and external tire model interface have been extended for the parallelized calculation of the external tire model namely COSIN FTire. The new interface speeds up the simulation by about a factor of three compared with the old interface for FTire.

The external tire model interface to COSIN FTire also adopts a dynamic library loader that automatically detects the FTire solver as installed by the FTire installer.

### Electrified powertrain enhancement

Back-spinning of wheel with electric motor is prevented when the battery is recharged with regenerative brake.

## VS Wrappers

### dSPACE RT Unreal Live Animation and Remote Data Access

The BikeSim solver wrapper for dSPACE SCALEXIO 64-bit Linux has been enhanced to utilize VS Connect to provide remote data access and synchronization capabilities.

This feature can be used to produce Live Animation of RT simulation runs using the VehicleSim Dynamics plugin for Unreal Engine. The VS Connect features of this wrapper also allow advanced

users to use the VS Connect API to write custom C/C++ programs that remotely access Imports and Outputs of the BikeSim solver while it is running on the RT system.

For more information, see the example Run **{RT: dSPACE} SCALEXIO: Unreal Engine Live Animation**”, and the new tech memo **Unreal Engine: Live Animation with Simulink**.

## Support for Speedgoat Real-Time Platform

The VS solvers now support the Speedgoat Real-Time platform: Performance and Mobile. The RT system is QNX 7.1 64bit. Software is MATLAB/Speedgoat R2001a or newer. The Speedgoat platform is supported by the existing VS Browser (using the **Models: Transfer to Remote RT Target** library). Two example runs were added to the database and the **Model Extensions and RT > External Models and RT Systems** documentation was updated.

## VS Browser: Graphic User Interface (GUI)

Minor changes were made to some of the existing screens.

1. The **Models: Simulink** screen has a new drop-down control for models with three kinds of VS S-Functions:
  - a. The Simulink model has a single VS S-Function for the simulation.
  - b. The Simulink model has multiple VS S-Functions, each for a separate vehicle. The vehicle simulations are run in parallel in Simulink using the **Tools > Parallel VS Math Models** screen.
  - c. The Simulink model has multiple VS S-Functions, each for a different stage of the VS Math Model calculations. The S-Functions are run in series to support in-line extensions to the VS Math Model from Simulink. When this mode is selected, the screen blue links to four sets of I/O ports, each for a different stage and associated S-Function.

**Note** This change is in support for an extension of the architecture of the VS Math Model. That change was not ready for the 2023.0 release of BikeSim, but is expected for the 2023.1 release.

2. The **Payload: Custom** screen has a new drop-down control to specify the reference for the Z coordinate of the payload: sprung mass coordinate system or trailer front hitch height. (This option is like one that was added in 2022.1 to the **Payload: Box Shape** screen.)
3. External tire interface to COSIN FTire model adopts a dynamic library loader which automatically detects FTire solver under FTire installation. Therefore, **Tire (External)** screen has changed to remove the **Tire program file (DLL)** field when FTire model is selected.

## VS Software Development Kit (SDK)

The `vs_output` API has been updated to allow `.mat` file I/O.

## Documentation

The following document was added to the **Help** menu:

1. Real-Time and DS Systems > Speedgoat Guide for VehicleSim Products

The following Reference Manuals have been updated:

1. System Parameters in VS Math Models
2. VS Browser (GUI and Database)
3. VS Commands
4. VS Commands Summary
5. VS Math Models

The following Screen documents have been updated:

6. Animator > Vehicles and Sensor Targets
7. Model Extensions and RT > External Models and RT Systems
8. Paths and Road Surfaces
9. Payloads
10. Setting Up Import and Output Variables
11. Tires > Tire Models (Motorcycle)

The following Technical Memos have been updated:

12. Example: Extending a Model with VS Commands and the API
13. GPS and UTM Coordinates

The following Real-Time and DS System documents have been updated:

14. dSPACE RT Guide
15. VI-Grade DriveSim & VehicleSim Dynamics

The following SDK documents have been updated:

16. The VehicleSim API
17. VS Output API: Reading and Accessing VS Output Files

The following Unreal documents have been updated:

18. Unreal Engine & Python Co-simulation using VS Connect
19. VehicleSim Dynamics plugin for Unreal Engine example using VS Connect

## Database

Additions were made in some of the run categories. The following new categories (with associated CPAR archive files) were added.

### *Alternative Coordinates*

VS Math Models can now generate Universal Transverse Mercator coordinates, as shown in a new example run.

### *Echo File Options*

The Quick Start Guide example was run with different settings that affect the information shown in Echo files.

### *New Signs*

Several runs were made showing many highways signs (VS Visualizer resources) that were added to the database.

### *New VS Commands*

An improved steer controller example was added.