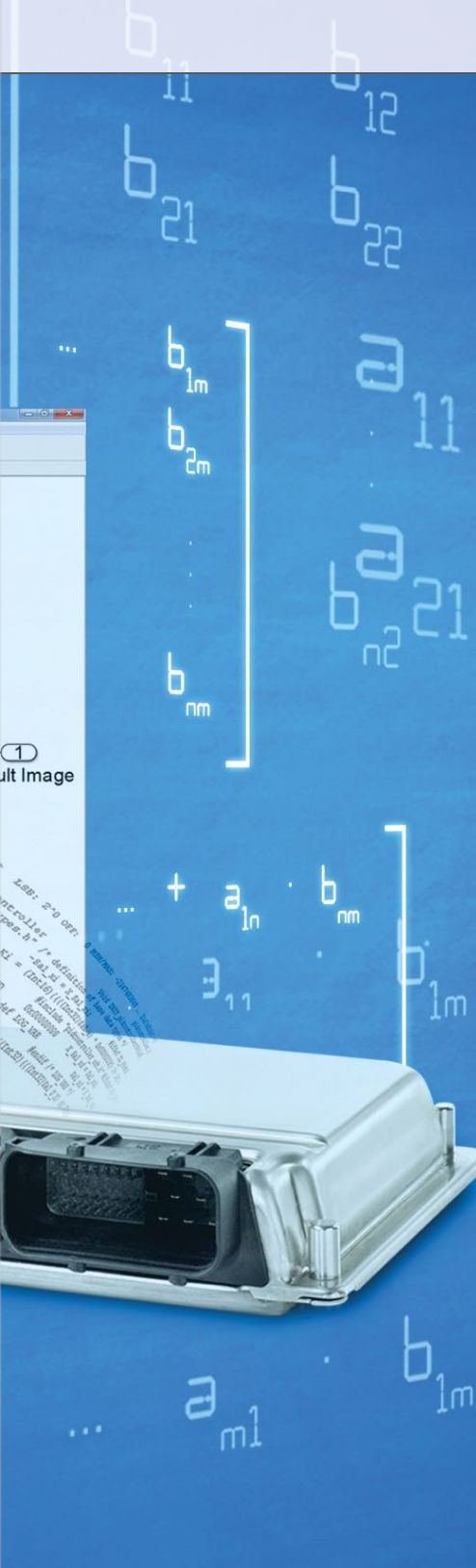


Code Generation 4.0

The latest version of dSPACE's production code generator TargetLink offers a new range of helpful functionalities. These include comprehensive matrix support, compatibility with current AUTOSAR versions, improved handling of C structures, and a user-friendly Data Dictionary.



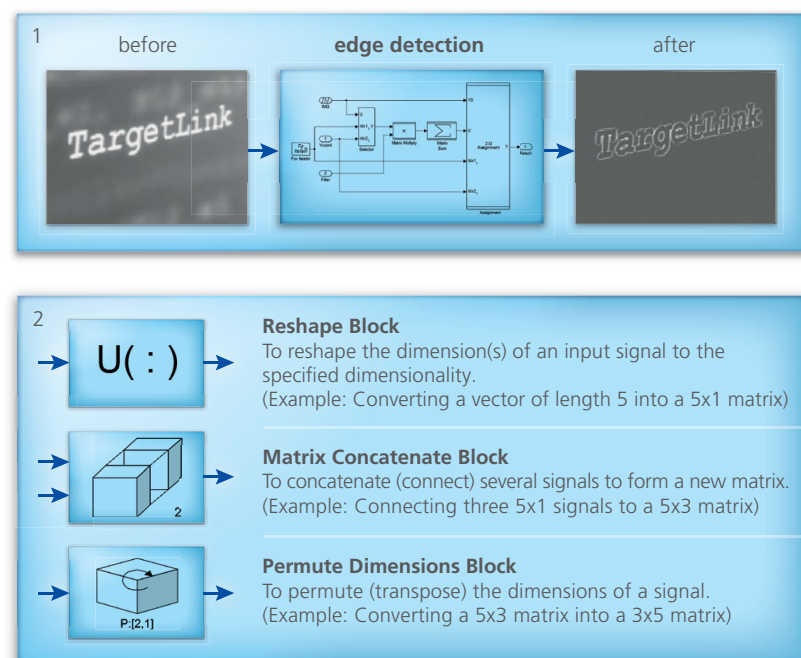
Matrix support prepares TargetLink® 4.0 for a high number of new applications. These applications include advanced driver assistance systems (ADAS), state-space controls, and sensor data fusion, because they typically display signals as matrices and use operations from linear algebra. Thanks to matrix support, the advantages of model-based development can now also be used for these algorithms (figure 1). TargetLink's well-known optimizations that minimize RAM, ROM, stack and execution time are available for these algorithms as well. In order to work with matrices, the user only has to specify two-dimensional sig-

nals in the TargetLink model. TargetLink then treats these signals in the same way as vectors and scalar signals. This also applies to operation in AUTOSAR mode, without any restrictions. The elements of the TargetLink block library process the matrix signals and TargetLink now also supports the Reshape, Permute Dimension and Matrix Concatenate blocks (figure 2). When combining these with the existing Selector and Assignment blocks, the user has many possibilities to create, manipulate, and split matrix signals. TargetLink users can use Custom Code blocks, which are also matrix-compatible, to perform operations that require complex algorithms,

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Figure 1 (top): Example of TargetLink matrix support for edge detection.

Figure 2 (bottom): Overview of additional Simulink blocks for working with matrices that are supported as of TargetLink 4.0.



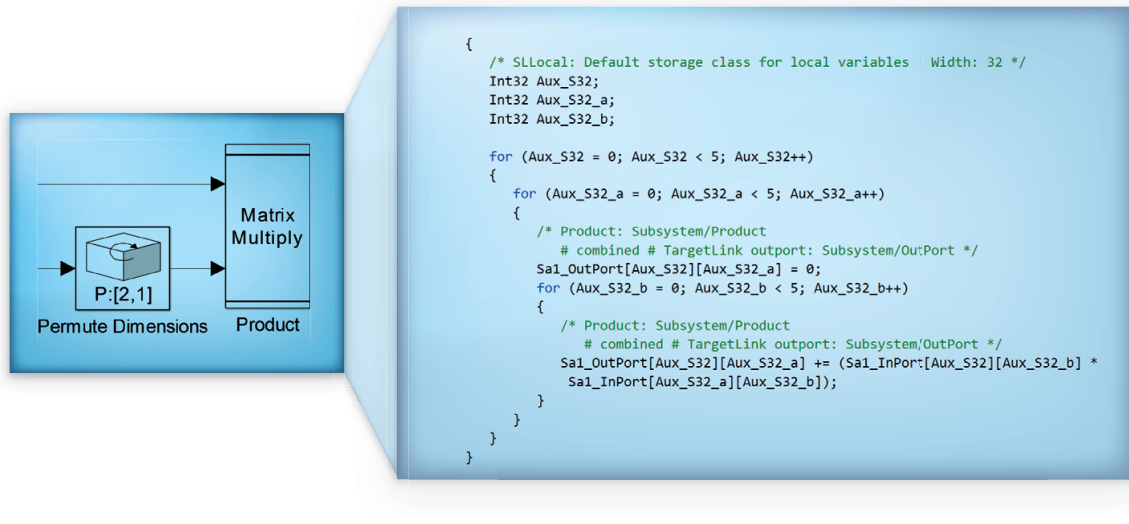


Figure 3: TargetLink generates efficient, readable matrix code that can be easily integrated with legacy code. Adjusted indexing avoids intermediate variables and unnecessary operations. In this example, indexing is adjusted for the combination of transposition and multiplication.

dSPACE TargetLink 4.0 – High-Quality Matrix Support for Future Innovations

such as calculating inverse matrices, determinants or other forms of matrix calculations. This makes it easy for users to incorporate, for example, optimized implementations of these algorithms that are available for the target processor. For matrices, TargetLink generates efficient and readable C code. In the C code, matrices are created as two-dimensional arrays, which makes integrating it with legacy code much easier. In addition,

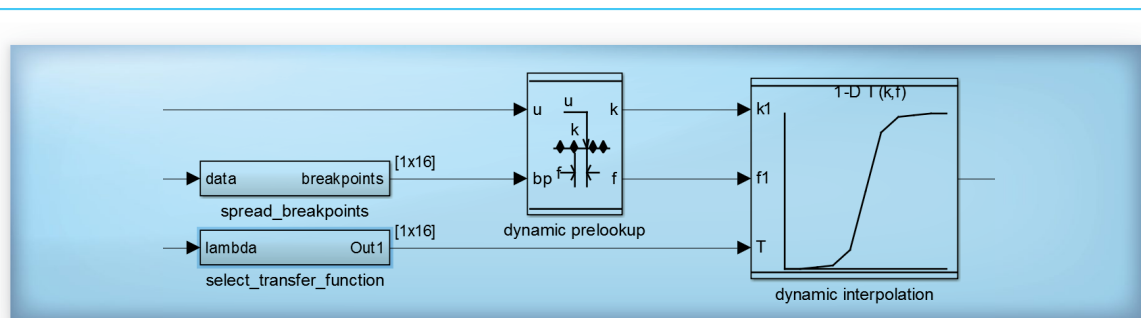
TargetLink automatically reduces the row and column vectors to C arrays. From a TargetLink point of view, the newly supported Simulink blocks are virtual blocks. This means that the Code Generator knows their behavior and optimizes it in many cases so that no operations or intermediate variables occur (figure 3).

Dynamic Look-up Tables

The dynamic look-up tables (1-D

and 2-D) introduced with TargetLink 4.0 help users develop adaptive controllers. The two blocks Direct Look-Up Table (n-D) and Interpolation (n-D) using PreLook-Up (figure 4) support dynamic input variables, both for 1-D and for 2-D tables – thanks to matrix support. Once the user has specified that a look-up table is to be used as a block's input, the block offers an additional port for its values. These mechanisms let TargetLink process a high

Figure 4: The two blocks dynamic prelookup and dynamic interpolation now support dynamic data points and values and thus new applications, such as adaptive controllers.



Matrix support	<ul style="list-style-type: none"> Comprehensive new functions for working with matrix signals (such as matrix generation, splitting, and matrix operations). Many new application areas such as ADAS applications, state-space controls and sensor fusion.
Dynamic look-up tables	<ul style="list-style-type: none"> Ability to change table entries (1-D and 2-D tables) during run time. This makes it possible to implement a high number of complex, adaptive control algorithms.
Improved usability of the Data Dictionary	<ul style="list-style-type: none"> User-defined views in the Data Dictionary Manager (e.g., automatically hiding rarely used properties) Embedded instant help (automatic display of descriptions for selected objects and properties)
Easier specification of structures in C code	<ul style="list-style-type: none"> Ability to define a structure type in the TargetLink Data Dictionary and assign this type to a complete Simulink bus. Assigning individual bus signals is no longer necessary.
Automatic interface generation for subsystems	<ul style="list-style-type: none"> Defining model and function interfaces with the Data Dictionary and automatically generating subsystem frames. This makes distributed work easier.
Newly supported systems/software/standards	<ul style="list-style-type: none"> MATLAB R2014b and R2014a, both 32-bit and 64-bit versions AUTOSAR Releases 4.1.3, 4.1.2 and 3.2.3. Support for AUTOSAR Release 4.2.1 (provided separately) DO-178C (safety standard for software development in aviation; for the DO-178C workflow document, send an e-mail to: TargetLink.Info@dSPACE.de)

TargetLink 4.0 – New Features at a Glance

number of control algorithms with its well-known efficiency.

Improved Usability of the Data Dictionary

An even better usability, especially of the Data Dictionary Manager, makes working on models easy and helps avoid mistakes. As an example, user-configurable views can be used to automatically hide rarely used properties so the users only see the settings that are most important for them. A further improvement is embedded help (figure 5), which describes and explains the selected objects and properties, saving the user a separate search.

Easier C Code Structure Specification

TargetLink 4.0 makes specifying C structures for Simulink buses much easier. In previous versions, users often had to assign each bus signal separately to a structure element. Now, users can simply set a structure type or structure variable that is defined in the Data Dictionary. Once specified, these types and variables can be used consistently throughout the entire model and

used together. TargetLink ensures that the bus and variable match and maps them automatically. This saves time and avoids errors. These new possibilities can be applied for all bus-capable blocks such as ports, Merge blocks or Unit Delay blocks. This gives advanced users more

optimization possibilities, letting them generate code that is even more efficient. ■

Figure 5: In TargetLink 4.0's Data Dictionary Manager, an embedded instant help (2) with helpful explanations can be displayed for selected objects and properties, LSB (1) in this example. This saves the user a separate search process.

