

Implementing C-Coded S-Functions for RTI

Keywords

C S-function; templates; size information; MEX DLL file; MEX compilers; S-functions; Real-Time Interface®; Simulink Coder®; RTI; different C code; excluding code segments; real-time simulation; Simulink® simulation

Question

I want to implement a C-coded S-function for use with Real-Time Workshop/Simulink Coder/Real-Time Interface (RTI) and for Simulink simulations. Where can I find an S-function template and examples?

Do I have to compile this S-function to a MEX DLL file? Which MEX compilers are supported and recommended?

I want to include or exclude specific code segments from my S-function for either Simulink simulation or real-time simulation (e.g., to access hardware components of other platforms). How do I do this?

Relevant Products

Real-Time Interface (RTI)

Solution

Where can I find an S-function template and examples?

The MATLAB® installation provides several C-coded S-function examples in `<MATLAB_InstallationPath>\simulink\src`. This folder also contains the S-function template `sfuntmpl_basic.c` and a more detailed commented version, `sfuntmpl_doc.c`. Further useful S-function examples are located under the following paths:

- `<MATLAB_InstallationPath>\toolbox\simulink\simdemos\simfeatures\src`
- `<MATLAB_InstallationPath>\extern\examples\refbook\`

If you want to modify an RTI-specific S-function, take the desired original S-function C file from one of the following folders:

- `<RCP_HIL_InstallationPath>\MATLAB\RTI\RTI<XXXX>\SFcn\` (as of dSPACE Release 7.4)
- `<RCP_HIL_InstallationPath>\MATLAB\RTI<XXXX>\SFcn\` (up to dSPACE Release 7.3).

Do I have to compile this S-function to a MEX DLL file?

For each C-coded S-function you want to use with RTI, you must provide the MEX DLL file for the following reasons:

- Simulink needs the MEX DLL file for simulation.
- Simulink Coder (formerly Real-Time Workshop) obtains the S-function's size information from the MEX DLL file. However, the MEX DLL file is not loaded to the dSPACE hardware, but RTI compiles and links the S-function source code with the specific target compiler for the respective dSPACE platform. Therefore, the MEX compiler has no specific impact on RTI.
- You have to generate a new MEX DLL file from the S-function C source file only if the S-function's size information has changed.

Which MEX compilers are supported and recommended?

Refer to [FAQ 009](#) Annotations about MEX DLLs and MEX Compilers.

To include or exclude specific code segments

Use the MATLAB_MEX_FILE macro in your S-function as shown in the following code excerpt:

```
#ifndef MATLAB_MEX_FILE
/* --- Code for Simulink simulation only. --- */
/* Code only used for Simulink simulation that you */
/* want to exclude from the real-time object file, for */
/* example, an output on the host computer's screen. */
#else
/* --- Code for real-time simulation only. --- */
/* Code only used for real-time simulation that */
/* you want to exclude from the Simulink S-function, */
/* for example, dSPACE-specific I/O code. */
/* Instead of the #ifdef ... #else construct you can */
/* also use the line #ifndef MATLAB_MEX_FILE; for */
/* example, if there is no need for Simulink-only code.*/
#endif
```

The MATLAB_MEX_FILE macro is defined if the S-function source code is compiled for building the MEX DLL and is not defined when it is compiled for RTI.

Related dSPACE HelpDesk Documents

- *Inserting Custom C Code in the RTI and RTI-MP Implementation Guide.*

Related FAQs

- [FAQ 009](#): Annotations about MEX DLLs and MEX Compilers
- [FAQ 202](#): C-S-Function Techniques

FAQ Overview

<http://www.dspace.com/go/faq>

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dSPACE strongly recommends to use the most recent patches for your dSPACE installation.

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