**Step-by-Step Tutorial: Installing MinGW and Lightspeed for MATLAB R2019a**

This tutorial provides a detailed guide to install the MinGW-w64 compiler and the Lightspeed package for MATLAB R2019a. Follow these steps to ensure a successful installation.

**1. Install MinGW-w64 Compiler**

MATLAB requires a supported compiler to compile MEX files. The MinGW-w64 compiler is officially supported and can be installed as follows:

**Step 1.1: Download the MinGW Add-On**

1. Open MATLAB R2019a.
2. Go to the **Home** tab and click on **Add-Ons** > **Get Add-Ons**.
3. In the Add-On Explorer, search for:

MATLAB Support for MinGW-w64 C/C++/Fortran Compiler

1. Alternatively, you can directly download the add-on from this link:  
   [MATLAB Support for MinGW-w64 C/C++/Fortran Compiler](https://www.mathworks.com/matlabcentral/fileexchange/52848-matlab-support-for-mingw-w64-c-c-fortran-compiler).
2. Click **Install** to download and install the MinGW-w64 compiler (version 5.3.0).

**Step 1.2: Verify the Compiler Installation**

1. After installation, verify that MATLAB recognizes the compiler by running the following command in the MATLAB Command Window:

mex -setup C++

1. MATLAB should display a message confirming that the MinGW-w64 compiler is selected as the default compiler.

**2. Download and Extract the Lightspeed Package**

1. Download the Lightspeed package from its source (e.g., GitHub or a shared repository).
2. Extract the package to a directory on your system. For example:

C:\matlab\lightspeed

**3. Add Lightspeed to MATLAB Path**

1. Open MATLAB.
2. Add the Lightspeed directory to your MATLAB path by creating or editing the startup.m file:
3. Locate the startup.m file in your MATLAB directory (usually C:\Users\<YourUsername>\Documents\MATLAB).
4. If the file does not exist, create a new one.
5. Add the following line to the file:

```matlab

addpath(genpath('C:\matlab\lightspeed'))

```

Replace `C:\matlab\lightspeed` with the actual path to the Lightspeed directory.

4. Save the file.

**4. Compile the Lightspeed MEX Files**

**Step 4.1: Navigate to the Lightspeed Directory**

1. In MATLAB, navigate to the Lightspeed directory:

cd('C:\matlab\lightspeed')

**Step 4.2: Modify the install\_lightspeed.m Script**

The install\_lightspeed.m script may need modifications to work with MATLAB R2019a and the MinGW-w64 compiler.

1. Open the install\_lightspeed.m file in MATLAB:

edit install\_lightspeed

1. Locate the line where the flags variable is defined (around line 55). It might look like this:

flags = ' -R2018a';

1. Change the value of flags to use the -R2017b compatibility mode:

flags = ' -R2017b ';

1. Save the changes to the script.

**Step 4.3: Run the Installation Script**

1. Run the installation script to compile the MEX files:

install\_lightspeed

1. If the installation is successful, MATLAB will display messages indicating that the MEX files were compiled.

**5. Verify the Installation**

1. Test the Lightspeed package to ensure it works correctly:

test\_lightspeed

1. This script will run a series of tests. If all tests pass, the installation was successful.

**6. Troubleshooting**

**Common Issues and Fixes**

* **Error: Reference to non-existent field 'LIBLOC'**:
  + Modify the install\_lightspeed.m script to manually specify the library directory. Replace:
  + libdir = options.LIBLOC;

With:

libdir = fullfile(matlabroot, 'extern', 'lib', computer('arch'), 'microsoft');

* **Error: Separate complex matrix function mxGetPi was called**:
  + Ensure the flags variable in the install\_lightspeed.m script is set to -R2017b.
* **Warnings about INFINITY and NAN being redefined**:
  + These warnings can be ignored unless they cause runtime issues. If needed, edit the util.c file to remove or comment out the conflicting definitions.

**7. Final Notes**

* Ensure that the MinGW-w64 compiler is properly installed and configured before running the Lightspeed installation script.
* Always test the package after installation to verify that it works correctly.
* For more information about the MinGW-w64 compiler, visit the [MATLAB Support for MinGW-w64 C/C++/Fortran Compiler](https://www.mathworks.com/matlabcentral/fileexchange/52848-matlab-support-for-mingw-w64-c-c-fortran-compiler) page.

By following this guide, you should be able to successfully install and configure the MinGW-w64 compiler and the Lightspeed package for MATLAB R2019a. If you encounter any issues, feel free to seek help from the MATLAB community or consult the official documentation.