



RADIOSS User's Code Interface

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Generating RADIOSS User Libraries

Chapter 8



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8.0 Generating RADIOSS User Libraries

8.1 RADIOSS UserLib SDK Overview

RADIOSS user libraries are built on Windows and Linux with two different compilers: Intel Fortran or Gfortran.

The RADIOSS UserLib SDK permits generating a dynamic library made of libraries and compiling scripts for a range of Linux and Windows versions.

```
userlib_sdk
├── linux64           : Linux 64 Bit with Intel Compiler 12.1.3 or Higher
├── linux64_gfortran : Linux 64 Bit with GNU Gfortran 4.4.5 or Higher
├── linux64_sp       : Linux 64 Bit Single Precision with INTEL Compiler 12.1.3 or Higher
├── linux64_sp_gfortran : Linux 64 Bit Single Precision with GNU Gfortran 4.4.5 or Higher
├── win64            : Windows 64 Bits with INTEL Compiler 12.1.3 or higher
├── win64_gfortran   : Windows 64 Bits with GNU MinGW Fortran 4.9.2
└── win64_sp         : Windows 64 Bits Single Precision with INTEL Compiler 12.1.3 or
                    higher
```

Each directory contains a static library and a build script.

8.2 Pre-requisites

8.2.1 OS Version

The recommended operating system is the same as the recommended operating system for HyperWorks.

8.2.2 Compiler

Install the compiler that best fits your needs:

- INTEL Compiler for Linux and Windows:
 - Install INTEL Compiler 12.1.2 or higher. Refer to Intel installation instructions.
 - More information can be found at <https://software.intel.com/en-us/fortran-compilers>
- Gfortran for Linux
 - Gfortran is embedded in the Linux distribution. Install it using Linux Package installer.
 - Gfortran must be version 4.4.5 or higher.
- MinGW Gfortran compiler for Windows
 - MinGW is a Windows port of the GNU gcc and Gfortran compiler.
 - Download MinGW Gfortran at <http://sourceforge.net/projects/mingw-w64/> and choose the following install options:
 - Version: **4.92** or higher
 - Architecture: **X86_64**
 - Thread: **win32**
 - Exception: **seh**
 - Build Revision: **Latest**

8.3 UserLib SDK Installation

8.3.1 SDK Location

The RADIOSS UserLib SDK is shipped in HyperWorks installation and located in %ALTAIR_HOME%/hwsolvers/radioass/userlib_sdk.

If you received the SDK in a separate package, copy it in your target directory.

8.3.2 Environment Variable Settings

Set two environment variables:

1. RAD_USERLIB_SDK_PATH: PATH to SDK ROOT

The following examples were installed with HyperWorks and ALTAIR_HOME environment variable set.

- **Linux (bash):**

```
export RAD_USERLIB_SDK_PATH=$ALTAIR_HOME/hwsolvers/radioass/userlib_sdk
```

- **Windows:**

```
set RAD_USERLIB_SDK_PATH=%ALTAIR_HOME%\hwsolvers\radioass\userlib_sdk
```

2. RAD_USERLIB_ARCH: The target Architecture Windows/Linux compiler flavor

- **Linux (bash):**

```
export RAD_USERLIB_ARCH=linux64
```

8.4 Generating a Dynamic Library Using the Build Script

Each UserLib version has its own script.

```

userlib_sdk
├── linux64                : build_userlib_linux64.sh
├── linux64_gfortran      : build_userlib_linux64_gfortran.sh
├── linux64_sp            : build_userlib_linux64_sp.sh
├── linux64_sp_gfortran   : build_userlib_linux64_sp_gfortran.sh
├── win64                 : build_userlib_win64.bat
├── win64_gfortran        : build_userlib_win64_gfortran.bat
└── win64_sp              : build_userlib_win64_sp.bat
    
```

8.4.1 Script Arguments

All scripts have command line arguments to permit the library generation. Their functionality are same. The syntax between the Linux and Windows scripts are different, though.

Execute the script without any argument to see all available options.

8.4.1.1 Windows Scripts

```

*****
** Generating Radioss Dynamic User Library **
*****

build_userlib_win64.bat /STARTER "Starter source files" /ENGINE "Engine Source files"
/LIBRARY "additional static Library" /OUTFILE Library_name [Optional Argument]

[Optional Argument]
/FREE : Source code is in Fortran 90 Free Format
/ADDFLAG "Additional compiler Flags" : Additional compiler flags to set
    
```

Script	Description
/STARTER	Starter source files. Add these files in quotation marks.
/ENGINE	Engine source files. Add these files in quotation marks.
/LIBRARY	Optional. Additional static library for link.
/OUTFILE	Optional. A specified library name other than the default.
/FREE	Optional. Use this if source code is written in Fortran 95 Free Format.
/ADDFLAG	Optional. Use this to set additional compiler flags. Add flags in quotation marks.

Example: Compiling law 29 for shells: LECM29.F and SIGEPS29C.F and generating a library with the default name.

```
F:\>%RAD_USERLIB_SDK_PATH%\%RAD_USERLIB_ARCH%\build_userlib_win64.bat /STARTER "lecm29.F"
/ENGINE "sigeps29c.F"

F:\>echo off

*****
** Generating Radioss Dynamic User Library **
*****

Preparing Library
-----

Compiling: lecm29.F
-----

lecm29.F

Compiling: sigeps29c.F
-----

sigeps29c.F

Creating library: libraduser_win64.dll
-----

    Creating library libraduser_win64.lib
    Creating object libraduser_win64.dll

Done
----

F:\>
```

8.4.1.2 Linux scripts

```
*****
** Generating Radioss Dynamic user library **
*****

Script Usage

build_userlib_linux64.sh starter="Starter source files" engine="Engine Source files"
library="Additional static Library" outfile="Optional library name" [Optional Arguments]

[Optional Arguments]
-free : Source files are in Fortran 90 Free Format
-addflag "Additional Compiling Arguments" - Advanced Users Only
```

Script	Description
starter	Starter source files. Add quotation marks if more than one file is set.
Engine	Engine source files. Add quotation marks if more than one file is set.
library	Optional. Additional static library for link.
outfile	Optional. A specified library name other than the default.
-free	Use this option if source code is written in Fortran 95 Free Format.
- addflag'' ''	Advanced user only. Use this to set additional compiler flags. Add flags in quotation marks.

Example: Compiling law 29 for shells: LECM29.F and SIGEPS29C.F and generating a library with the default name.

```
neo DDS/LOI29> $RAD_USERLIB_SDK_PATH/$RAD_USERLIB_ARCH/build_userlib_linux64.sh
starter="lecm29.F" engine="sigeps29c.F"
```

```
*****
** Generating Radioss Dynamic user library **
*****
```

```
Compiling: lecm29.F
```

```
-----
```

```
Compiling: sigeps29c.F
```

```
-----
```

```
Creating library: libraduser_linux64.so
```

```
-----
```

```
Done
```

```
----
```

8.4.2 Generated Library Name

In Windows, the default generated library is named **libraduser_win64.dll** if /OUTFILE "Alternate library name" is not set.

In Linux, the default generated library is named **libraduser_linux64.so** if outfile="Alternate library name" is not set.

8.5 RADIOSS Starter and Engine Behavior

8.5.1 RADIOSS Starter and Engine Load Sequence

When using the alternate library name option, use `-dylib [library name]` command line argument in Starter or Engine subroutines to load the library.

The library load sequence below in Starter and Engine subroutines is in order of priority.

1. `-dylib [alternate library name]` command line argument
2. If `RAD_USERLIB_LIBPATH` is set, load `libraduser_win64.dll` or `libraduser_linux64.so` in the directory defined in this environment variable.
3. Load `libraduser_win64.dll` or `libraduser_linux64.so` in the local execution directory.
4. Load `libraduser_win64.dll` or `libraduser_linux64.so` using the `%PATH%` environment variable (Windows) or `$LD_LIBRARY_PATH` environment variable (Linux).

8.5.2 Starter and Engine Behave

A message is printed in the output files when the library is successfully loaded.

Windows 64 example:

```
EXTERNAL LIBRARY FOR USERS CODE INTERFACE
-----
LIBRARY NAME      . . . . . libraduser_win64.dll
RADIOSS USERS CODE INTERFACE VERSION . . . . . 1301504220
```

When user options are used in the RADIOSS Input Deck, the code in the user library is used.