The IMSL® C Numerical Library
Getting Started Guide – A Technical Guide by Rogue Wave Software
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Installing IMSL C Numerical Library

1. Executing the install program

Confirm you have the appropriate tar file for the hardware platform and operating system. The <tarfile> in the commands below display the name cnl-2016.0.0sus121gc485x64.tar. Execute the following commands from the directory that contains the downloaded archive:

tar xzf <tarfile>
imsl/install/imsl_install

2. License Agreement

This screen presents the end user license agreement. Press the <space bar> to scroll through to read the contents.
When you reach the end of the license agreement, enter “y” and then <Enter> to continue the installation.
4. Installation Information

This dialog introduces the install procedure. Press <Enter> to continue.

5. Install Directory

Set the installation directory. The default is the directory in which the installation script is executed. You are prompted for confirmation. Press <Enter>.
At the next dialog, confirm your selection by pressing "y" and <enter> again.

6. Introduction to the CNL Modules

This dialog introduces the modules that are available for installation as part of the IMSL C Numerical Library. Press <Enter> to continue to the selection screen.
7. MKL Information

You may optionally install an MKL performance version of the IMSL C Numerical Library. This
dialog is simply informational and does not configure the installer to install the module.

Press <Enter> to continue.

This installation gives the installer the option of installing an
additional version of IMSL C Numerical Library which leverages the
Intel(R) Math Kernel Library (MKL) to enhance performance in functions
that use BLAS, FFTs, or LAPACK routines. Note that MKL is not covered
by the IMSL License Agreement. Go to www.intel.com to obtain more
information on Intel's MKL License Agreement.

By selecting the MKL-enabled version of the IMSL Library,
both the standard IMSL and MKL-enabled versions will be installed
and the LINK_CNL environment variable will link with the
MKL-enabled versions of the libraries.

By choosing not to select the MKL-enabled versions, only the
standard IMSL version of the libraries will be installed and the
LINK_CNL environment variable will link with the standard IMSL
versions of the libraries. No link environment variables will
be created for the MKL-enabled versions of the libraries. Refer
to the README files referenced at the conclusion of the installation
for more information.

By default the MKL-enabled version of the libraries are not selected.

Press <ENTER> or <RETURN> to continue:  ■
8. CUDA Information

You may optionally install a CUDA performance version of the IMSL C Numerical Library. This dialog is simply informational and does not configure the installer to install the module.

Press <Enter> to continue.
9. Module Selection

Review the list of available modules for Linux and type the corresponding numbers to toggle the selection. Select x to exit this menu and continue with installation.

<table>
<thead>
<tr>
<th>MOD NUM</th>
<th>Selection</th>
<th>SIZE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>MANDATORY</td>
<td>1</td>
<td>51812</td>
<td>C Numerical Library (Standard), Linux (x64), gcc 4.8.5</td>
</tr>
<tr>
<td>NOT SELECTED</td>
<td>2</td>
<td>290064</td>
<td>C Numerical Library (MKL-enabled), Linux (x64), gcc 4.8.5</td>
</tr>
<tr>
<td>NOT SELECTED</td>
<td>3</td>
<td>184090</td>
<td>C Numerical Library (CUDA-enabled), Linux (x64), gcc 4.8.5</td>
</tr>
<tr>
<td>SELECTED</td>
<td>4</td>
<td>94652</td>
<td>C Numerical Library Online Documentation</td>
</tr>
<tr>
<td>x Exit Options Menu -- continue with installation</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Space Required For Selected Modules: 136164 KB
To toggle modules between SELECTED and NOT SELECTED, enter the number of the module (i.e. 2 or 3) and press RETURN.

Enter option: [ ]

10. Hard Disk Space Confirmation

The required disk space is computed and compared to the amount of disk space available. To continue, enter c and press <Enter>. Press q to quit the install program or m to modify the selected modules.

The installation that you have selected requires 136164 KB of disk space.
It appears that you have 30432256 KB of disk space. This is sufficient space to allow the installation to complete successfully.
Enter C to continue with the installation, Q to quit the installation, or M to modify the selected modules: [ ]
11. License Number

If you have a License Number, enter it. If you do not yet have a license number, or are evaluating the product, use the default 999999. Press <Enter> and then "y" to continue to the installation.

![Image showing IMPL Installation screen with license number input]

12. Installation Complete

When the install program is finished decompressing and copying files, you are presented with summary notes and returned to the command prompt.

![Image showing IMPL Installation screen with installation complete message]
License Key Setup

This step is necessary only if you have an evaluation copy of IMSL C Numerical Library.

Using a text editor, create the license file <install_dir>/license/imsl_eval.dat, where <install_dir> is the IMSL C Numerical Library installation directory. Then, cut and paste the contents of the file you received via e-mail from the Rogue Wave License Administrator.

Note: To customize the license file name, set the environment variable IMSL_LIC_FILE to point to the license file name and the location of your choice (<path>/<name>).

Using the IMSL C Numerical Library

1. Documentation

Documentation is supplied in both PDF and HTML formats, available from the main documentation page at <install_dir>/imsl/cnl-2016.0.0/help. Open the file imsl.html using your web browser.
2. Creating a program

This simple example program solves the following system of linear equations:

\[
\begin{align*}
33x + 16y + 72z &= 129 \\
-24x -10y -57z &= -96 \\
18x -11y + 7z &= 8.5 \\
\end{align*}
\]

Copy the following text into an editor and save the file as cnl.c.

```c
/* Program start */
/* The header file for Mathematics of the IMSL C Numerical Library. */
/* For Statistics, use <imsls.h>. */
#include <imsl.h>

main()
{
    /* variable declaration */
    int n = 3;
    float *x;
    static float a[3] = {33.0, 16.0, 72.0, -24.0, -10.0, -57.0, 18.0, -11.0, 7.0};
    static float b[3] = {129.0, -96.0, 8.5};
    float *p_inva;

    /* The main IMSL function call to solve for x in Ax=B. */
    * This is the floating point version, to use
    * double-precision arguments, call
    * imsl_d_lin_sol_gen */
    x = imsl_f_lin_sol_gen(n, a, b, 0);

    /* Optional arguments are included after required */
    * arguments. These are usually preceded by a constant
    * named IMSL_* indicating which optional argument is
    * being passed. In this example, we request the
    * inverse of the a matrix */
```
x = imsl_f_lin_sol_gen(n, a, b, IMSL_INVERSE, &p_inva, 0);

/* Print the solution x and the inverse of a using
 * write_matrix, a printing utility */
imsl_f_write_matrix("Solution x", 1, n, x, 0);
imsl_f_write_matrix("Inverse of A", n, n, p_inva, 0);
}

/* Program end */

3. Compiling and running the program

The following steps detail how to compile and execute a program that uses the IMSL C Numerical Library for UNIX/Linux.

Setting the Environment Variables

Configure a setup shell script with the necessary environment variables required for compilation. Which shell script to use depends on the shell:

For the IMSL C Numerical Library Version 8.6 on Linux

C Shell
source <install_dir>/imsl/cnl-2016.0.0/<env>/bin/cnlsetup.csh

bash, bourne, K Shell
. <install_dir>/imsl/cnl-2016.0.0/<env>/bin/cnlsetup.sh

Compile the program

Shared Library
$CC $CFLAGS cnl.c -o cnl $LINK_CNL_SHARED

Static Library
$CC $CFLAGS cnl.c -o cnl $LINK_CNL_STATIC
Execute the program

./cnl

Solution x

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.0</td>
<td>1.5</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Inverse of A

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.1464</td>
<td>0.1899</td>
<td>0.0403</td>
</tr>
<tr>
<td>2</td>
<td>0.1802</td>
<td>0.2237</td>
<td>-0.0321</td>
</tr>
<tr>
<td>3</td>
<td>-0.0933</td>
<td>-0.1367</td>
<td>-0.0113</td>
</tr>
</tbody>
</table>

For more information, refer to the readme files in
<install_dir>/ims1/cnl-2016.0.0/<env>/notes.