McCAD v1.0
User Manual

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Contents

0.1 Introduction

McCAD is a C++ library for the conversion of CAD solid models to MCNP input syntax, from Boundary Representation "BREP" to Constructive Solid Geometry "CSG".

0.2 Installation from Source

Building of the McCAD library is supported on both Linux and Windows operating systems. The library has three 3rd-party dependencies: CMake, Boost C++ libraries, and Open CASCADE Technology. CMake is the standard build system for McCAD and it comes by default with most Linux distributions as well as Windows OS. Boost C++ libraries consist of header files that are utilized for parallel processing in McCAD. Open CASCADE Technology (OCCT) is used as a geometry engine for geometical solids manipulation and decomposition. Below are guiding steps for installation on both Linux and Win systems.

0.2.1 Linux

Listed below are the currently supported Linux distributions:

- Ubuntu 20.04 LTS
- Ubuntu 18.04 LTS

Testing of installation on other distributions is still underway! thus Ubuntu is recommended as a distribution to install McCAD. Below are general steps to install McCAD code and its dependencies.

- **CMake**
  - Download cmake-3.23.0.tar.gz from https://cmake.org/download/ then execute the commands below in a terminal.
  - $ tar -xzvf cmake-3.23.0.tar.gz
  - $ cd cmake-3.23.0
  - $ mkdir build
  - $ cd build
  - $ cmake .. -DCMAKE_USE_OPENSSL=OFF -DCMAKE_INSTALL_PREFIX=.
  - $ make
  - $ make install
- **Boost C++ liraries**
  - Download boost_1_78_0.tar.gz from https://www.boost.org/users/download/ then execute the commands below in a terminal.
  - $ tar -xvzf boost_1_78_0.tar.gz
  - $ cd boost_1_78_0
  - $ mkdir build
  - $ cd tools/build
  - $ ./bootstrap.sh

  - $ ./b2 install --prefix=../../build/

- **Open CASCADE Technology (OCCT)**
  - *NOTE*: the instructions on the installation of dependencies can be found on the side menu in https://dev.opencascade.org/doc/occt-7.5.0/overview/html/index.html by navigating to "Build, Debug and Upgrade > Build 3rd-parties" then following the instructions under "Installation from Official Repositories".
  - Download opencascade-7.5.0.tgz from https://dev.opencascade.org/release/previous then execute the commands below in a terminal.
  - $ tar -xzvf opencascade-7.5.0.tgz
  - $ cd opencascade-7.5.0
  - $ mkdir build
  - $ cd build
  - $ cmake .. -DCMAKE_BUILD_TYPE=Release -DBUILD_LIBRARY_TYPE=Shared -DCMAKE_INSTALL_PREFIX=. -DINSTALL_TEST_CASES=TRUE -DINSTALL_DOC_Overview=TRUE
  - $ make
  - $ make install

- **McCAD**
  - *NOTE*: building a shared library is recommended! Should a static library be needed, the user has to insure a compliant build of Open CASCADE Technology by changing the build type; -DBUILD_LIBRARY_TYPE=STATIC.
  - $ git clone https://github.com/inr-kit/McCAD_Library
  - $ cd McCAD_Library
  - $ mkdir build
  - $ cd build
  - $ CMake .. -DCMAKE_INSTALL_PREFIX=. -DBUILD_STATIC=OFF -DBOOST_CUSTOM_ROOT=<PATH to boost_1_78_0> -DOCC_CUSTOM_ROOT=<PATH to opencascade-7.5.0/build> -DBUILD_RPATH=ON
  - $ make
  - $ make install

0.2.2 Windows

Listed below are the currently supported Windows versions:

- Windows 10

Testing of installation on other versions is still underway! Below are general steps to build McCAD library and its dependencies.

- **CMake** (optional)
  - *NOTE*: If usage of IDE - such Microsoft Visual Studio (VS) - is intended, then installing CMake can be skipped since most IDE builds CMake by default.

  - Download and run the installer cmake-3.23.1-windows-x86_64.msi from https://cmake.org/download/.

- **Microsoft Visual Studio** (optional)
  - Download and run the "community" installer from https://visualstudio.microsoft.com/downloads/.

- **Boost C++ liraries**
  - Download boost_1_78_0.zip from https://www.boost.org/users/download/.
  - Unzip boost_1_78_0.zip.
  - Documentation can be found in index.html in the unzipped folder.

- **Open CASCADE Technology (OCCT)**
  - Download and run the installer opencascade-7.5.0-vc14-64.exe from https://dev.opencascade.org/release/previous.

- **McCAD**
  - Download source code from https://github.com/inr-kit/McCAD_Library by selecting Code > Download ZIP.
  - Unzip McCAD_Library.
  - Open MSVC and select the McCAD_Library.
  - From the "Solution Explorer - Folder Review" double click CMakeSettings.json file. This will open the file in IDE.
  - Set a "Configuration name".
  - Ensure that "Configuration type" is set to "Release" and "Toolset" is set to msvc_x64_x64.
  - Add -DBUILD_RPATH=ON -DBUILD_STATIC_EXE=ON -DBUILD_SHARED=OFF -DBOOST_CUSTOM_ROOT="<PATH to boost_1_78_0>" -DOCC_CUSTOM_ROOT="<PATH to OpenCASCADE-7.5.0-vc14-64\opencascade-7.5.0>" to "CMake command arguments".
  - From the top menu select "Build > Build All".
  - From the top menu select "Build > Install McCAD".

0.3 I/O

Input and output file formats. Coming soon ...

0.3.1 Decomposition

0.3.2 Conversion

0.4 Notes on Usage

General notes on how to use McCAD. Coming soon ...

0.4.1 Decomposition

0.4.2 Conversion

- Coordinates

0.5 Known Issues

A list of known issues and how to manually fix it in solid models. Coming soon ...

0.5.1 Decomposition

- simplifying of tori
- hollow solids
- splitting of cylinders and tori

0.5.2 Conversion

0.6 Theory of McCAD Conversion

Comperhensive details on the inner workings of McCAD classes for developers. Coming soon ...

0.6.1 Decomposition

0.6.2 Conversion