
KratosMultiphysics

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Contents

1	Overview	3
1.1	What is Kratos?	3
1.2	Who may use <i>Kratos</i> ?	3
1.3	Who is <i>Kratos</i> ?	4
1.4	Keywords	4
2	Getting Kratos Binaries for Linux	5
2.1	Minimum requirements	5
2.2	Download and Installation	5
2.3	Usage	5
3	Indices and tables	7

WORK IN PROGRESS

KratosMultiphysics (*Katos*) is a framework for building parallel, multi-disciplinary simulation software, aiming at modularity, extensibility, and high performance, under a BSD license. Kratos is written in C++, and counts with an extensive Python interface

1.1 What is Kratos?

Kratos is a framework for building multi-disciplinary finite element programs. It provides several tools for easy implementation of finite element applications and a common platform providing effortless interaction between them. *Kratos* has an innovative variable base interface designed to be used at different levels of abstraction and implemented to be very clear and extendible. It also provides an efficient yet flexible data structure which can be used to store any type of data in a type-safe manner. The [Python](#) scripting language is used to define the main procedure of *Kratos* which significantly improves the flexibility of the framework in time of use.

The kernel and application approach is used to reduce the possible conflicts arising between developers of different fields. Also layers are designed to reflect the working space of different people, considering their programming knowledge.

Kratos is parallelized for *Shared Memory Machines* (SMM) and *Distributed Memory Machines* (DMM). In the same way it provides tools for its applications to adapt easily their algorithms to these architectures. Its scalability has been verified up to thousands of cores.

If you have not visited the general [CIMNE Kratos Website](#), you can do it to have an overview of the capabilities of *Kratos*

Follow *Kratos* on [Twitter!](#)

1.2 Who may use *Kratos*?

Some potential users of *Kratos* are:

- **Finite Element Developers:** These developers are considered to be more expert in **FEM**, from the physical and mathematical points of view, than C++ programming. For this reason, *Kratos* provides their requirements without involving them in advanced programming concepts.
- **Application Developers:** These users are less interested in finite element programming and their programming knowledge may vary from very expert to higher than basic. They may use not only *Kratos* itself but also

any other applications provided by finite element developers, or other application developers. Developers of optimization programs or design tools are the typical users of this kind.

- Package Users Engineers: and designers are other users of *Kratos*. They use the complete package of *Kratos* and its applications to model and solve their problem without getting involved in internal programming of this package. For these users *Kratos* has to provide a flexible external interface to enable them use different features of *Kratos* without changing its implementation.

1.3 Who is *Kratos*?

The *Kratos* structure, due to its multi disciplinary nature, has to support the wide variety of algorithms involved in different areas. That's the principal reason that explain the variety of people, mostly engineers, composing the *Kratos* Community.

1.4 Keywords

Multiphysic, Finite Element Method, C++ Open Source Code, Free

Kratos is **MULTIPHYSIC**. One of the main topics in engineering nowadays is the combination of different analysis (thermal, fluid dynamic, structural) with optimising methods in one global software package with just one user interface and, even more, the possibility to extend the implemented solution to new problems.

Kratos is **FINITE ELEMENT METHOD (FEM)** based. Many problems in engineering and applied science are governed by **Partial Differential Equations (PDE)**, easily handled by computer thanks to numerical methods. The **FEM** is one of the most powerful, flexible and versatile existing methods.

Kratos is **OBJECT ORIENTED**. An integration of disciplines, in the physical as well as in the mathematical sense, suggests the use of the modern object oriented philosophy from the computational point of view. The modular design, hierarchy and abstraction of these approaches fits to the generality, flexibility and reusability required for the current and future challenges in numerical methods.

Kratos is **OPEN SOURCE**. The main code and program structure is available and aimed to grow with the need of any user willing to expand it. The **[BSD](https://github.com/KratosMultiphysics/Kratos/wiki/_new) (Berkeley Software Distribution)** licence allows to use and distribute the existing code without any restriction, but with the possibility to develop new parts of the code on an open or close basis depending on the developers.

Kratos is **FREE** because is devoted mainly to developers, researchers and students and, therefore, is the most fruitful way to share knowledge and built a robust numerical methods laboratory adapted to their users' needs. Free because you have the freedom to modify and distribute the software. The one thing you're not able to do with free software is take away other people's freedom. Please, read the license for more detailed information.

Getting Kratos Binaries for Linux

This page covers the process of downloading a compiled version of Kratos for Linux and how to use it to run an example.

2.1 Minimum requirements

Ubuntu 14.04 or greater. Other flavors of Linux are supported but not tested.

2.2 Download and Installation

You can find the Kratos binaries for Linux in the [Release Section](#):

- 1) Download the tgz file for linux
- 2) Extract the contents of the tgz in a location of your choice
- 3) Recommended: Execute the `install.sh` script

This finalizes the installation process.

2.3 Usage

- Download any example of your interest from the [Examples Repository](#) and execute:

```
>kratos MainKratos.py
```

2.3.1 Advanced

If you prefer to skip the installation part, or have multiple versions of kratos installed simultaneously:

1) Copy this runner.sh script and edit the contents of the KRATOS_ROOT variable:

```
KRATOS_ROOT=/path/to/kratos # Please change this variable
export PYTHONHOME=${KRATOS_ROOT}
export PYTHONPATH=${KRATOS_ROOT}:${KRATOS_ROOT}/python34.zip
export LD_LIBRARY_PATH=${KRATOS_ROOT}/libs:${KRATOS_ROOT}/OpenMPI/lib:/home/roigcarlo/
↳KratosInstall/libs
${KRATOS_ROOT}/runkratos $*
```

Do not forget to give the script execution rights:

```
>chmod +x runner.sh
```

2) Make an alias for the script

```
>echo "alias kratos=runner.sh" >> $HOME/.bashrc
```

3) Open the terminal and execute the problem script using kratos:

```
>kratos MainKratos.py
```

CHAPTER 3

Indices and tables

- `genindex`
- `modindex`
- `search`