Una introducción a la caja de herramientas DUNE Numerics para la solución de modelos matemáticos

Webinar 13 de Julio de 2021

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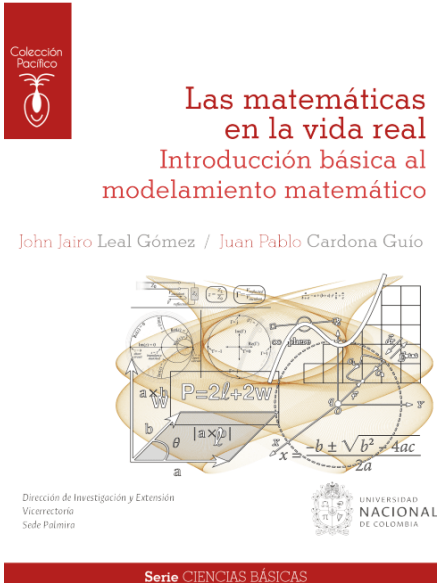


Capítulos:

1. Introducción a los números reales $\mathbb{R}$.
2. Introducción a las funciones.
3. La derivada.
4. Modelamiento matemático.
5. Anexos.

4.3 Situaciones cotidianas

En primer lugar, se muestran “expresiones” de situaciones cotidianas con sus respectivas representaciones como funciones y sus derivadas.

4.3.1 Encender la luz

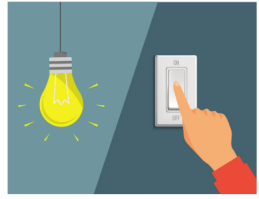


Figura 4.3.
Encender la luz

La acción de encender la luz, como en la figura 4.3, se puede escribir matemáticamente como el cambio en la posición del *switch* P como variable independiente o causa del fenómeno, y el efecto se puede ver en el cambio de la intensidad lumínica I. Esto quiere decir que la intensidad lumínica es una función de la posición del *switch* $I(P)$. La variación se puede escribir como:

$$\frac{dI}{dP} \qquad 4.1$$

Distributed and Unified Numerics Environment (DUNE)

- Software de código abierto bajo la licencia GNU General Public Licence 2 

- Disponible en macOS, Debian  , Ubuntu  , openSUSE  , Arch Linux  y FreeBSD  .
- Conjunto de bibliotecas C++ con enlaces a Python.
- Utilizado en la resolución de ecuaciones diferenciales parciales e implementación de métodos basados en mallas, por ejemplo diferencias finitas, elementos finitos o volúmenes finitos.

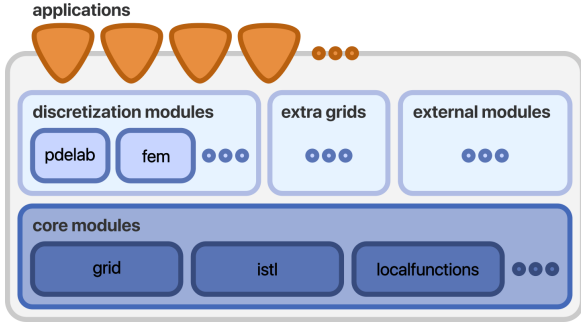


Figura: Tomado de `https://dune-project.org`.

Proyectos que emplean DUNE

- https://dune-project.org/about/dune
- https://dumux.org
- https://opm-project.org
- https://precice.org
- https://www.zib.de/projects/kaskade7-finite-element-toolbox

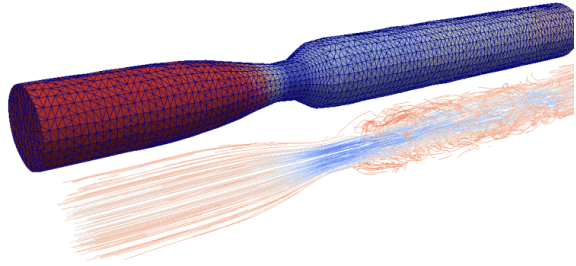


Figura: Tomado de https://dune-project.org.

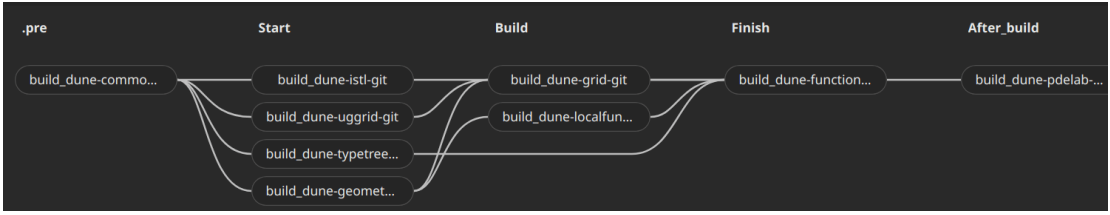


Figura: Tomado de
`https://gitlab.com/dune-archiso/repository/dune-archiso-repository-pdelab-git/-/pipelines`

dune-common Clases fundamentales e infraestructura para la construcción del sistema.

dune-geometry Elementos de referencia, métodos de cuadraturas y transformaciones geométricas.

dune-grid Interfaces con las mallas (ALUGrid, UGGrid, AlbertaGrid, YaspGrid), construcción y visualización.

dune-istl Biblioteca de solucionadores iterativas de plantillas, clases genéricas de matrices/vectores dispersos, solucionadores

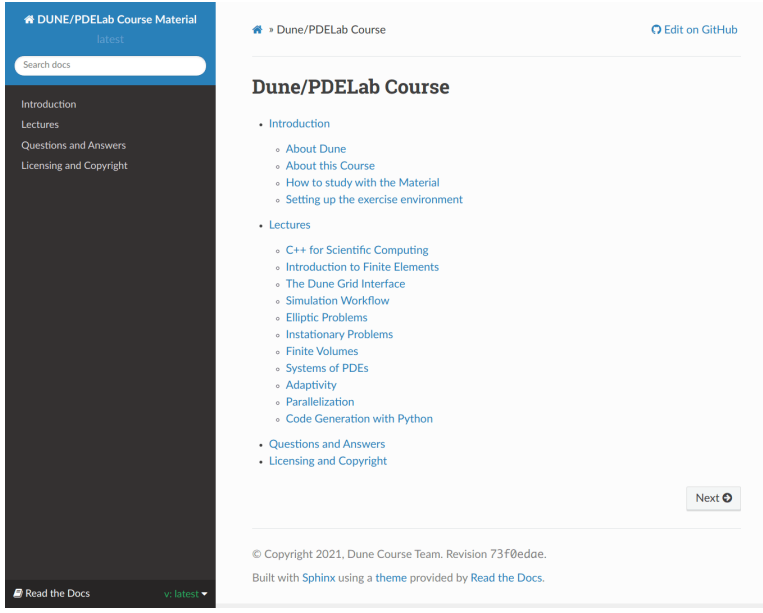
dune-localfunctions Interface genérica para funciones de elementos finitos.

dune-fem
- dune-grid
  - dune-geometry
    - dune-common

dumux
- dune-istl
- dune-localfunctions
- vc
- psurface
- superlu
- arpack++
- suitesparse
- dune-alugrid
- dune-subgrid
- fmt
- opm-common

opm-upscaling
- opm-grid
  - opm-common
    - dune-grid
      - dune-geometry
    - dune-istl
    - boost

opm-models
- opm-material
  - opm-common
    - dune-grid
      - dune-geometry
    - dune-istl
    - boost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Built with Sphinx using a theme provided by Read the Docs.

Listado: Programa `dune-basics.cc`.

```
#ifdef HAVE_CONFIG_H
#include "config.h"
#endif
#include <iostream>
#include <dune/common/parallel/mpihelper.hh> // An initializer of MPI
#include <dune/common/exceptions.hh>         // We use exceptions

int main(int argc, char **argv)
{
  try
  {
    // Maybe initialize MPI
    Dune::MPIHelper &helper = Dune::MPIHelper::instance(argc, argv);
    std::cout << "Hello World! This is dune-basics." << std::endl;
    if (Dune::MPIHelper::isFake)
      std::cout << "This is a sequential program." << std::endl;
    else
      std::cout << "I am rank " << helper.rank() << " of " << helper.size()
                << " processes!" << std::endl;
    return 0;
  }
  catch (Dune::Exception &e)
  {
    std::cerr << "Dune reported error: " << e << std::endl;
  }
  catch (...)
  {
    std::cerr << "Unknown exception thrown!" << std::endl;
  }
}
```

ParaView 5.4.1 64-bit

File Edit View Sources Filters Tools Catalyst Macros Help

Time: 175 175 (max is 200)

cg1_gfs_1 Surface

Pipeline Browser

builtin:

solution_navier_stokes-00*

Properties Information

Properties

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Search ... (use Esc to clear text)

Properties (

Cell/Point Array Status

cg2_dirichlet_gfs_0_0_pow2gf

cg2_dirichlet_gfs_0_0_pow2gf

cg1_gfs_1

Display (Un

Representation Surface

Coloring

Layout #1 +

RenderView1

2.0e+00
1.5
1
0.5
0
-0.5
-8.7e-01
cg1_gfs_1

[1]:
```
import matplotlib
matplotlib.rc( 'image', cmap='jet' )
import math

from ufl import *
from dune.ufl import Constant, DirichletBC
import dune.ufl
import dune.geometry as geometry
import dune.fem as fem
from dune.fem.plotting import plotPointData as plot
import matplotlib.pyplot as pyplot
```

set up polynomial order and radius of reference surface

[2]:
```
order = 2
R0 = 2.
```

We begin by setting up reference domain Γ_0 (`grid`), and the space on Γ_0 that describes $\Gamma(t)$ (`space`). From this we interpolate the non-spherical initial surface `positions` , and, then reconstruct `space` for the discrete solution on $\Gamma(t)$.

grid construction; dune grid format file

[3]:
```
from dune.fem.view import geometryGridView
from dune.fem.space import lagrange as solutionSpace
from dune.alugrid import aluConformGrid as leafGridView
```

Finite Elements

As another example we solve the poisson equation

$$\begin{aligned} -\Delta u &= f \qquad \text{in } \Omega, \\ u &= 0 \qquad \text{auf } \partial\Omega \end{aligned}$$

in Python based on a simplicial Dune grid: `ALUConformGrid` .

In [2]:
```
import time
import numpy
import math
```

Como primer paso construimos la grilla

In [3]:
```
from dune.grid import cartesianDomain, gridFunction
from dune.alugrid import aluConformGrid
vertices = numpy.array([(0,0), (1,0), (1,1), (0,1), (-1,1), (-1,0), (-1,-1), (0,-1)])
triangles = numpy.array([(2,0,1), (0,2,3), (4,0,3), (0,4,5), (6,0,5), (0,6,7)])
aluView = aluConformGrid({"vertices": vertices, "simplices": triangles})
aluView.hierarchicalGrid.globalRefine(7)
```

C++ review DUNE

Una organización donde compartir notas acerca de C++ con pdfs escritos en LaTeX.

America stackoverflow.com/c/cpp-review-dune

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introductory-review
Un repositorio donde compartir notas acerca de C++ con pdfs escritos en LaTeX.
Dockerfile 1

hdnum Template
C++

dune-basics Template
An example module that says Hello World.
TeX

github-starter-course Template
github-starter-course created by GitHub Classroom

cpp-examples Template
Forked from igormcoelho-learning/autograding-example-cpp-catch
Example of C/C++ autograding with Catch2 library - GitHub Classroom
C++

sandbox Template
Forked from corneliusludmann/gitpod-playground
This repository intentionally left empty. It merely serves as an entry point for personal Gitpod experiments.

Find a repository... Type Language Sort New

6 results for repositories written in **C++** sorted by **last updated**

Clear filter

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Study of book Scientific Programming Advanced Concepts of Christian Engwer

dune-archiso

Archiso profile based on CyberOS with DUNE Numerics

Status: Beta Brought to you by: carlosal1015

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Linux

This is a live USB containing a full operating system that can be booted, this means that you can use a USB stick to burn this image or virtualize it to Linux-KVM, QEMU, Virtualbox, VMWare, Hyper-V. We included the following repositories:
- Arch Linux Core [Official]
- Arch Linux Extra [Official]
- Arch Linux Community [Official]
- Arch Linux Multilib [Official]
- Arch4Edu [Third-party]
- Cyber [Third-party]
- Dune-archiso-repository-core [Third-party]
- Dune-archiso-repository-extra [Third-party]

In addition, we provide the packages of some modules of DUNE Numerics (version 2.7.1), DuMux (version 3.4) and the Open Porous Media (version 2021.04). The full list of packages is described in https://dune-archiso.gitlab.io/packages

Enjoy. I don't belong to dune-project. All the blame falls on me (github.com/carlosal1015).

- Libros
- Artículos

- Sitios web

¡Muchas gracias!

Presentación disponible en:

`https://cpp-review-dune.github.io/webinar/slides.pdf`

Grabación disponible en:

`https://player.vimeo.com/video/572717824`

Dudas, sugerencias o preguntas a:

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caznaranl@uni.pe