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

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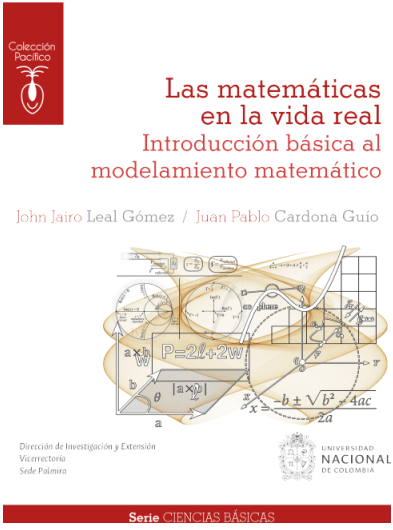
Presentación del libro



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

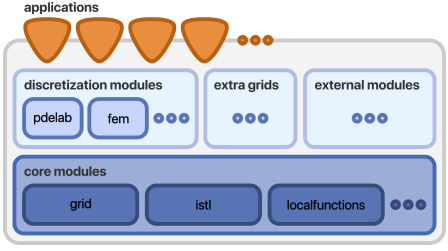
La acción de encender la luz, como en la figura 4.3, se puede escribir matemáticamente como el cambio en la posición del *switch* P como variable independiente o causa del fenómeno, y el efecto se puede ver en el cambio de la intensidad lumínica I. Esto quiere decir que la intensidad lumínica es una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

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

DUNE Numerics Project

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 de plantillas en moderno con enlaces a .
- Implementación eficiente de las estructuras de datos y los algoritmos en interfaces abstractas.
- Para la resolución numérica de ecuaciones diferenciales parciales e implementación de esquemas basados en mallas, por ejemplo, *diferencias finitas*, *elementos finitos* o *volúmenes finitos*.



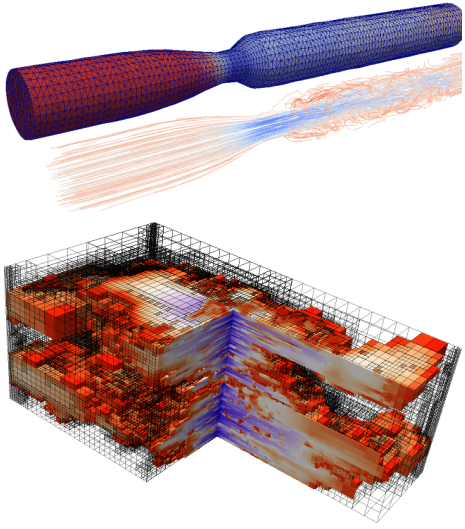
Origen: `https://dune-project.org/about/dune`.

Figura: Los binarios están disponible en el repositorio Arch Linux for Education (Jingbei Li, Carlos Aznarán y otros, octubre 2022).

DUNE Numerics Project

Proyectos que emplean DUNE

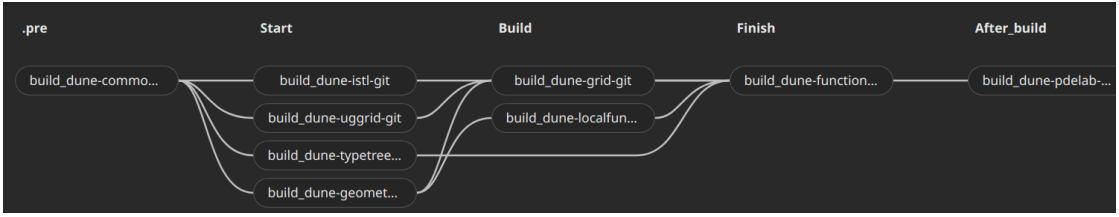
- https://dumux.org
- https://opm-project.org
- https://precice.org
- https://amdis.readthedocs.io
- https://github.com/parafields
- https://www.zib.de/projects/kaskade7-finite-element-toolbox



Origen: https://dune-project.org/gallery.

El DUNE verso: módulos

https://dune-project.org/groups/core



Origen: 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).

dune-istl Biblioteca de plantillas para solucionadores iterativos, clases genéricas de matrices/vectores dispersos.

dune-localfunctions Interface genérica para funciones de elementos finitos.

El DUNE verso: módulos

Dependencias de algunos módulos

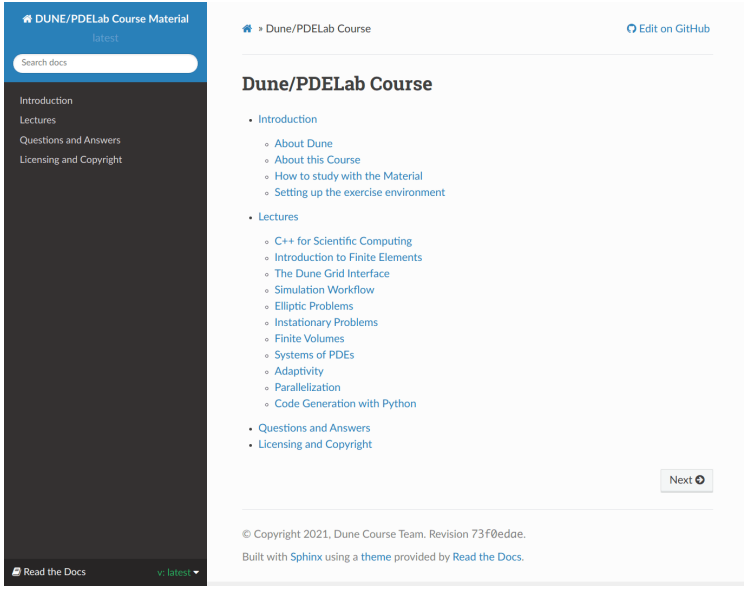
- dune-fem
  - dune-alugrid
  - dune-istl
  - dune-localfunctions
  - python-fenics-ufl
  - python-matplotlib
  - python-scipy
  - dune-polygongrid (opcional)
  - dune-spgrid (opcional)
  - eigen (opcional)
  - papi (opcional)
- opm-models
  - dune-alugrid
  - dune-localfunctions
  - opm-grid
    - opm-common
    - suitesparse
    - zoltan
  - dune-fem (opcional)

- dumux
  - dune-grid
  - dune-istl
  - dune-localfunctions
  - dune-alugrid (opcional)
  - dune-foamgrid (opcional)
  - dune-functions (opcional)
  - dune-mmesh (opcional)
  - dune-spgrid (opcional)
  - dune-subgrid (opcional)
  - opm-grid (opcional)

- dune-pdelab
  - arpack++
  - dune-alugrid
  - dune-functions
  - suitesparse
  - superlu
  - dune-multidomaingrid (opcional)

Curso de DUNE/PDELab 2021

https://dune-pdelab-course.readthedocs.io



Snippet en C++

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

Apply Reset Delete ?

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

Snippet en Python

https://dune-project.org/sphinx/content/sphinx/dune-fem

Eigenvalue problems

FURTHER TOPICS

Grid Views: Adaptivity and Moving Domains

Overview and some basic grid views (level and filtered)

Dynamic Local Grid Refinement and Coarsening

Evolving Domains

Mean Curvature Flow

Using C++ Code Snippets

EXTENSION MODULES

Discontinuous Galerkin Methods: the DUNE-FEM-DG Module

Virtual Element Methods: the DUNE-VEM module

USER PROJECTS

HP adaptive DG scheme for twophase flow problem

Mixed-dimensional PDEs: the Dune-MMesh module

INFORMATION AND RESOURCES

Information for C++ Developers

[1]:
```
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 $\Gamma(t)$.

[3]:
```
from dune.fem.view import geometryGridView
from dune.fem.space import lagrange as solutionSpace
from dune.alugrid import aluConformGrid as leafGridView
gridView = leafGridView("sphere.dgf", dimgrid=2, dimworld=3)
space = solutionSpace(gridView, dimRange=gridView.dimWorld, order=order)
u = TrialFunction(space)
v = TestFunction(space)
x = SpatialCoordinate(space)
# positions = space.interpolate(x * (1 + 0.5*sin(2*pi*x[0]*x[1])* cos(pi*x[2])), name="posi
positions = space.interpolate(x * (1 + 0.5*sin(2*pi*(x[0]+x[1]))*cos(0.25*pi*x[2])), name="
surface = geometryGridView(positions)
space = solutionSpace(surface, dimRange=surface.dimWorld, order=order)
solution = space.interpolate(x, name="solution")
```

```
GridParameterBlock: Parameter 'bisectioncompatibility' not specified, defaulting to '0' (fa
```

Finite Elements

As another example, we solve the Poisson equation

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

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

[1]:
```
import numpy as np
from dune.grid import cartesianDomain, gridFunction
from dune.alugrid import aluConformGrid
```

[2]:
```
vertices = np.array([(0, 0), (1, 0), (1, 1), (0, 1),
                     (-1, 1), (-1, 0), (-1, -1), (0, -1)])
triangles = np.array([(2, 0, 1), (0, 2, 3), (4, 0, 3),
                      (0, 4, 5), (6, 0, 5), (0, 6, 7)])
```

[3]:
```
aluView = aluConformGrid({"vertices": vertices, "simplices": triangles})
aluView.hierarchicalGrid.globalRefine(2)
```

```
DUNE-INFO: Generating dune-py module in /home/carlosal1015/.cache/dune-py
DUNE-INFO: Compiling HierarchicalGrid (new)
DUNE-INFO: Compiling ReferenceElements (new)
DUNE-INFO: Compiling ReferenceElements (new)
DUNE-INFO: Compiling ReferenceElements (new)
```

C++ review DUNE

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

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

Repositories 21 Packages People 10 Teams 1 Settings

Pinned repositories

Customize pinned repositories

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

Top languages

C++ TeX Python Jupyter Notebook Dockerfile

study-scientific-programming

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

Add a Review

Downloads: 11 This Week

Last Update: 2021-06-15

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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).

Referencias

- Libros

Oliver Sander. *DUNE — The Distributed and Unified Numerics Environment*. First. Lecture Notes in Computational Science and Engineering 140. Springer International Publishing, 2020. ISBN: 978-3-030-59701-6. DOI: 10.1007/978-3-030-59702-3.

- Artículos

Martin Alkämper, Andreas Dedner, Robert Klöfkorn y Martin Nolte. "The DUNE-ALUGrid Module". En: *Archive of Numerical Software* 4.1 (2016). URL: https://journals.ub.uni-heidelberg.de/index.php/ans/article/view/23252.

Andreas Dedner y Martin Nolte. "The Dune Python Module". En: *CoRR* abs/1807.05252 (2018). eprint: 1807.05252. URL: http://arxiv.org/abs/1807.05252.

Peter Bastian et al. "The Dune framework: Basic concepts and recent developments". En: *Computers & Mathematics with Applications* 81.1 (1 de ene. de 2021). Development and Application of Open-source Software for Problems with Numerical PDEs, págs. 75-112. ISSN: 0898-1221. DOI: https://doi.org/10.1016/j.camwa.2020.06.007.

Referencias

- Sitios web


Oliver Sander. *The Distributed and Unified Numerics Environment (DUNE)*. 12 de abr. de 2016. URL: http://congress.cimne.com/icme2016/admin/files/filepaper/p72.pdf (visitado 12-07-2021).


Alexander Jaust. *Coupling fluid flows with DuMuX, preCICE workshop 2020*. 19 de feb. de 2020. URL: https://precice.org/precice-workshop-2020.html (visitado 12-07-2021).


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Dune Course Team. *Dune/PDELab Course*. 22 de oct. de 2020. URL: https://dune-pdelab-course.readthedocs.io (visitado 26-06-2021).

Agradecimientos

¡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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