Wave Equation

0.0

Generated by Doxygen 1.8.9.1

Thu Jul 23 2015 22:15:29

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Chapter 1

WaveEquation

C++ implementation of a 2D parallel wave equation solver using multiresolution analysis

Chapter 2

Hierarchical Index

2.1 Class Hierarchy

This inheritance list is sorted roughly, but not completely, alphabetically:

Grid 10
    Field 9
GuiMain 13
JFrame
    Gui 12
ActionListener
    Gui 12

Chapter 3

Class Index

3.1 Class List

Here are the classes, structs, unions and interfaces with brief descriptions:

Field 9
Grid 10
Gui 12
GuiMain 13

Chapter 4

File Index

4.1 File List

Here is a list of all documented files with brief descriptions:

/home/cfadden3/GitHub/WaveEquation/gui/**Gui.java**
GUI implementation for electromagnetic simulations 15
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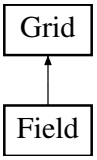
Class definition of the wave equation field 15
/home/cfadden3/GitHub/WaveEquation/include/**Grid.h**
Class definition for global electromagnetics grid 16

Chapter 5

Class Documentation

5.1 Field Class Reference

Inheritance diagram for Field:



Public Member Functions

- **Field** ()

  *Constructor of the **Field** (p. 9) class.*
- void **Update** (int)

  Updates the field value.
- double **Source** (int)

  Returns the source function value.
- void **Print** ()

  Outputs the field values.
- double **Dim2** (int, int)
- double & **AzOld** (int, int)
- double & **AzNew** (int, int)
- double & **Az** (int, int)
- double & **Ca** (int, int)

Additional Inherited Members

5.1.1 Constructor & Destructor Documentation

5.1.1.1 Field::Field ( )

Constructor of the **Field** (p. 9) class.

The field is initialized with values from the inheritance of the **Grid** (p. 10). Its values therefore depend on the default constructor of the **Grid** (p. 10).

5.1.2 Member Function Documentation

5.1.2.1 void Field::Print ( )

Outputs the field values.

This function prints the values of the field at all points to a csv file, so the results can be seen graphically.

5.1.2.2 double Field::Source (int *t*)

Returns the source function value.

This returns the value of the source, either gaussian or sine, and uses that to input power into the grid.

Parameters

t	the current time

Returns

the value of the source

5.1.2.3 void Field::Update (int *t*)

Updates the field value.

This function is in the time loop, and updates the field value using finite differences.

Parameters

n	the current number of iterations

Returns

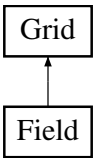
The field value is updated

The documentation for this class was generated from the following files:

- /home/cfadden3/GitHub/WaveEquation/include/**Field.h**
- /home/cfadden3/GitHub/WaveEquation/src/Field.cpp

5.2 Grid Class Reference

Inheritance diagram for Grid:



Public Member Functions

- **Grid** ()
  *Constructor of the **Grid*** (p. *10) class.*
- int **getMaxTime** ()
  returns the maximum time of simulation

Protected Types

- enum **Source** { **HARMONIC**, **GAUSSIAN** }

Protected Member Functions

- double **HarmonicSource** (int)

  Returns value of the harmonic source.
- double **GaussianSource** (int)

  Returns value of the gaussian source.

Protected Attributes

- int **SizeX**
- int **SizeY**
- int **t** = 0
- int **MaxTime**
- int **isrc**
- int **jsrc**
- const int **cc** = 299792458
- const double **mu0** = 16 ∗ atan(1) ∗ 1.0e-7
- const double **eps0** = 1.0 / (cc ∗ cc ∗ mu0)
- double **dx**
- double **dy**
- double **dt**
- Source **src**
- double **freq**
- std::vector< double > **epsr**
- std::vector< double > **mur**

5.2.1 Constructor & Destructor Documentation

5.2.1.1 Grid::Grid ( )

Constructor of the **Grid** (p. 10) class.

The grid is initialized using values taken from the file created by the Java GUI. Please take note of the main python script used to run this, and keep in mind the filename is hardcoded at this time.

5.2.2 Member Function Documentation

5.2.2.1 double Grid::GaussianSource (int *t*) [protected]

Returns value of the gaussian source.

This evaluates a gaussian source, an exponential raised to the x^2. This has the benefit in a time domain simulation of having multiple frequency components, and therefore can give a more broadband response for the simulation

Parameters

t	the time at which to evaluate the function

Returns

the value at the specified time

5.2.2.2 int Grid::getMaxTime ( )

returns the maximum time of simulation

This ensures protection of the **Grid** (p. 10) class variables, and acts as a get function for the main program

5.2.2.3 double Grid::HarmonicSource (int *t*) [protected]

Returns value of the harmonic source.

This evaluates a harmonic source, a sine wave, at the specified time, and returns that value. This has a single frequency content, and is mostly used for testing purposes.

Parameters

t	the time at which to evaluate the function

Returns

the value at the specified time

5.2.3 Member Data Documentation

5.2.3.1 int Grid::isrc [protected]

x-coordinate of the source on the grid

5.2.3.2 int Grid::jsrc [protected]

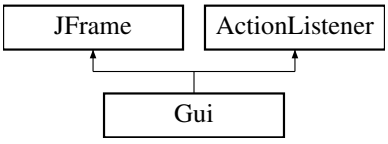
y-coordinate of the source on the grid

The documentation for this class was generated from the following files:

- /home/cfadden3/GitHub/WaveEquation/include/**Grid.h**
- /home/cfadden3/GitHub/WaveEquation/src/Grid.cpp

5.3 Gui Class Reference

Inheritance diagram for Gui:



Public Member Functions

- **Gui** ()

  Constructor the GUI class.
- void **actionPerformed** (ActionEvent event)

  Done button event handler.
- void **printToFile** ()

Static Public Attributes

- static JPanel **panel**

5.3.1 Constructor & Destructor Documentation

5.3.1.1 Gui.Gui ( ) [inline]

Constructor the GUI class.

This uses the GridBagLayout to arrange textboxes for input to electromagnetic simulations. Default values are set, and the user can choose to modify whichever parameters are preferred.

5.3.2 Member Function Documentation

5.3.2.1 void Gui.actionPerformed (ActionEvent *event*) [inline]

Done button event handler.

When the Done button is pushed, the current value in the textbox is taken, and then printed to a file.

The documentation for this class was generated from the following file:

- /home/cfadden3/GitHub/WaveEquation/gui/**Gui.java**

5.4 GuiMain Class Reference

Static Public Member Functions

- static void **main** (String[ ] args)

The documentation for this class was generated from the following file:

- /home/cfadden3/GitHub/WaveEquation/gui/GuiMain.java

Chapter 6

File Documentation

6.1 /home/cfadden3/GitHub/WaveEquation/gui/Gui.java File Reference

GUI implementation for electromagnetic simulations.

Classes

- class **Gui**

6.1.1 Detailed Description

GUI implementation for electromagnetic simulations.

Author

Chris Fadden

6.2 /home/cfadden3/GitHub/WaveEquation/include/Field.h File Reference

Class definition of the wave equation field.

```
#include "Grid.h"
```

Classes

- class **Field**

6.2.1 Detailed Description

Class definition of the wave equation field.

Author

Chris Fadden

6.3 /home/cfadden3/GitHub/WaveEquation/include/Grid.h File Reference

Class definition for global electromagnetics grid.

```
#include <cmath>
#include <vector>
#include <string>
```

Classes

- class **Grid**

6.3.1 Detailed Description

Class definition for global electromagnetics grid.

Author

Chris Fadden

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