MPI Implementation of some eigen libraries others

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Chapter 1

Hierarchical Index

1.1 Class Hierarchy

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

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background_task	
Complex	
Core	8
Audit	. 6
Grad	. 9
PassFail	. 14
InitiateVectorMethod < ItemType >	10
MPI_BC_Generic< T, Q, R >	11
MPI_sorting_methods	12
MPIInput	12
$OMP \! < T \! > \; \ldots \ldots$	13
Partstruct	
part1::Point	
Progression	15
ArithProgression	. 5
QTstyle_Test	16
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$Stack < T, CONT > \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots $	
StatisticalDistribution	18
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top:top:top:top:top:top:top:top:top:top:	23
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MPI_BC	. 10
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Vec< T >	. 24
Vec< char >	. 24
TestFixture	
VectorMethodTest	
Trap	
tutorial:: $Vec < T > \dots$	24

2 Hierarchical Index

Chapter 2

Class Index

2.1 Class List

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

Genfun::Argument
ArithProgression
Audit
background_task
Complex
Core
Grad
InitiateVectorMethod< ItemType >
MPI_BC
MPI_BC_Generic< T, Q, R >
MPI_sorting_methods
MPIInput 12
OMP< T >
Partstruct
PassFail
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QTstyle_Test
A test class - find and replace from this template for future class definitions
RandomNumberGenerator
Stack < T, CONT >
StandardNormalDistribution
Standard Normal Distribution Implementation
StatisticalDistribution
Statistical Distribution Class
Str
A constructor with a character pointer input
Student_info
SYN_Mat< T >
TemplateUnderTest< T >
Trap
tutorial::Vec< T >
Vec< T >
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4 Class Index

Chapter 3

Class Documentation

3.1 Genfun::Argument Class Reference

Public Member Functions

- Argument (int ndim=0)
- Argument (const Argument &)
- Argument (std::initializer_list< double >)
- const Argument & operator= (const Argument &)
- double & operator[] (int I)
- const double & operator[] (int i) const
- unsigned int dimension () const

Friends

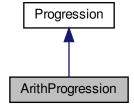
std::ostream & operator<< (std::ostream &o, const Argument &a)

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

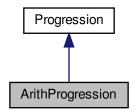
• /home/oohnohnoh1/Desktop/GIT/Research/Parallel/include/Argument.h

3.2 ArithProgression Class Reference

Inheritance diagram for ArithProgression:



Collaboration diagram for ArithProgression:



Public Member Functions

• ArithProgression (long i=1)

Protected Member Functions

• virtual long nextValue ()

Protected Attributes

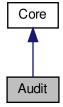
• long inc

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

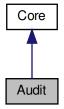
• /home/oohnohnoh1/Desktop/GIT/Research/Parallel/include/openmp2.hpp

3.3 Audit Class Reference

Inheritance diagram for Audit:



Collaboration diagram for Audit:



Public Member Functions

- Audit (std::istream &is)
- std::istream & read (std::istream &)
- double grade () const
- · bool valid () const
- bool fulfill_reqs () const

Additional Inherited Members

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

- /home/oohnohnoh1/Desktop/GIT/Research/Parallel/include/openmp dynamicbindingandinheritance.hpp
- /home/oohnohnoh1/Desktop/GIT/Research/Parallel/src/openmp_dynamicbindingandinheritance.cxx

3.4 background_task Class Reference

Public Member Functions

• void operator() () const

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

• /home/oohnohnoh1/Desktop/GIT/Research/Parallel/src/openmp_thread.cxx

3.5 Complex Class Reference

Public Member Functions

• Complex (double r, double i=0)

Friends

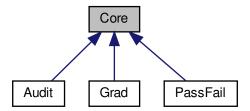
• bool operator== (const Complex &a, const Complex &b)

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

• /home/oohnohnoh1/Desktop/GIT/Research/Parallel/src/openmp2.cxx

3.6 Core Class Reference

Inheritance diagram for Core:



Public Member Functions

- Core (std::istream &is)
- std::string name () const
- virtual std::istream & read (std::istream &)
- virtual double grade () const
- virtual bool valid () const
- virtual bool fulfill_reqs () const

Protected Member Functions

- std::istream & read_common (std::istream &)
- virtual Core * clone () const

Protected Attributes

- std::string n
- · double midterm
- double final
- std::vector< double > homework

3.7 Grad Class Reference 9

Friends

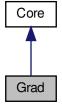
class Student_info

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

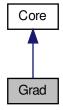
- /home/oohnohnoh1/Desktop/GIT/Research/Parallel/include/openmp_dynamicbindingandinheritance.hpp
- /home/oohnohnoh1/Desktop/GIT/Research/Parallel/src/openmp_dynamicbindingandinheritance.cxx

3.7 Grad Class Reference

Inheritance diagram for Grad:



Collaboration diagram for Grad:



Public Member Functions

- Grad (std::istream &is)
- std::istream & read (std::istream &)
- double grade () const
- bool fulfill_reqs () const

Additional Inherited Members

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

- /home/oohnohnoh1/Desktop/GIT/Research/Parallel/include/openmp_dynamicbindingandinheritance.hpp
- /home/oohnohnoh1/Desktop/GIT/Research/Parallel/src/openmp_dynamicbindingandinheritance.cxx

3.8 InitiateVectorMethod < ItemType > Class Template Reference

Public Member Functions

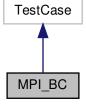
- · InitiateVectorMethod (int, int)
- void setup (int *)
- void traits ()
- · void SendVector ()
- · void GetData ()

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

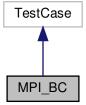
• /home/oohnohnoh1/Desktop/GIT/Research/Parallel/include/new.hpp

3.9 MPI_BC Class Reference

Inheritance diagram for MPI_BC:



Collaboration diagram for MPI_BC:



Public Member Functions

```
MPI_BC class template filling.
void Get_input (int, int, double *, double *, int *)
void packData ()
void time_ellapsed ()
void broadcast_input ()
void broadcast_vector ()
void buildMpiType (double *, double *, int *, MPI_Datatype *)
void Send (float, float, int, int)
void Receive (float *, float *, int *, int)
void parallelAllocateVec (double *, double *, int, std::vector < int > *, MPI_Datatype *)
```

3.9.1 Constructor & Destructor Documentation

```
3.9.1.1 MPI_BC()

MPI_BC::MPI_BC ( )
```

MPI_BC class template filling.

Placeholder

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

- /home/oohnohnoh1/Desktop/GIT/Research/Parallel/include/MPI_broadcast.hpp
- /home/oohnohnoh1/Desktop/GIT/Research/Parallel/src/MPI_broadcast.cxx

3.10 MPI_BC_Generic < T, Q, R > Class Template Reference

Public Member Functions

• MPI_BC_Generic (std::size_t n)

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

/home/oohnohnoh1/Desktop/GIT/Research/Parallel/include/MPI_broadcast.hpp

3.11 MPI_sorting_methods Class Reference

Public Member Functions

• void **Bubble_sort** (int a[], int n)

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

• /home/oohnohnoh1/Desktop/GIT/Research/Parallel/src/MPI reduce.cxx

3.12 MPIInput Class Reference

Public Member Functions

• void **I_send** ()

```
    MPIInput ()
        MPIInput class - constructor.
    MPIInput (int, int)
        MPIInput class - constructor.
    void MPIStart ()
        MPIInput class - MPIStart method.
    void getData ()
    void bubbleSort ()
    void oddEvenSort ()
```

3.12.1 Constructor & Destructor Documentation

The input constructor

int int constructor

3.12.2 Member Function Documentation

3.12.2.1 MPIStart()

```
void MPIInput::MPIStart ( )
```

MPIInput class - MPIStart method.

Sets up the processor ranks and size for use later - could really be incoporated into the consturcotr

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

- /home/oohnohnoh1/Desktop/GIT/Research/Parallel/include/MPI_IO.hpp
- /home/oohnohnoh1/Desktop/GIT/Research/Parallel/src/MPI_IO.cxx

3.13 OMP < T > Class Template Reference

Public Member Functions

- OMP (int)
- **OMP** (const **OMP** &OMPCopy)
- OMP & operator= (const OMP &ref)
- void add (T)
- void addup ()
- void **pi** ()

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

/home/oohnohnoh1/Desktop/GIT/Research/Parallel/include/openmp1.hpp

3.14 Partstruct Struct Reference

Public Attributes

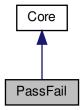
- · int class
- double d [6]
- char **b** [7]

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

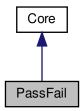
• /home/oohnohnoh1/Desktop/GIT/Research/Parallel/src/MPI_struct.cxx

3.15 PassFail Class Reference

Inheritance diagram for PassFail:



Collaboration diagram for PassFail:



Public Member Functions

- PassFail (std::istream &is)
- double **grade** () const
- · bool valid () const
- bool fulfill_reqs () const

Additional Inherited Members

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

• /home/oohnohnoh1/Desktop/GIT/Research/Parallel/include/openmp_dynamicbindingandinheritance.hpp

3.16 part1::Point Class Reference

#include <lib_mpi.hpp>

Public Member Functions

• **Point** (float _x, float _y, float _z)

Public Attributes

- float x
- float y
- float z

3.16.1 Detailed Description

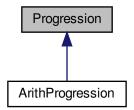
This is a simple 3D point class

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

/home/oohnohnoh1/Desktop/GIT/Research/Parallel/include/lib_mpi.hpp

3.17 Progression Class Reference

Inheritance diagram for Progression:



Public Member Functions

- **Progression** (long f=0)
- void **printProgression** (int n)

Protected Member Functions

- virtual long firstValue ()
- virtual long nextValue ()

Protected Attributes

- · long first
- · long cur

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

• /home/oohnohnoh1/Desktop/GIT/Research/Parallel/include/openmp2.hpp

3.18 QTstyle_Test Class Reference

A test class - find and replace from this template for future class definitions.

#include <statistics.h>

3.18.1 Detailed Description

A test class - find and replace from this template for future class definitions.

One of the most common examples of concepts in quantitiative finance is that of a statistical distribtion. Random variables play a huge part in quantitive financial modelling. Derivatives, pricing, cash-flow forceasting and quantitive trading all make use of statistical methods in some fashion

Many of the chapters within this book have made use of random number generators in order to carry out pricing tasks.

In a nutshell, we are splitting the generation of (uniform integer) random numbers from draws of specific statistical distribution,s such taht we can use the statics classes elsewhere withut bringing along the heavy random number generation functions.

Equally useful is the fact taht we will be able to "swap out" different random number generators for out statistics classes for reliability, extensibility and efficiency

A more elaborate class definition

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

/home/oohnohnoh1/Desktop/GIT/Research/Parallel/include/statistics.h

3.19 RandomNumberGenerator Class Reference

Public Member Functions

- RandomNumberGenerator (unsigned long _num_draws, unsigned long _init_seed)
- virtual unsigned long get_random_seed () const
- virtual void set_random_seed (unsigned long _seed)
- virtual void set num draws (unsigned long num draws)
- virtual unsigned long get_random_integer ()=0

Protected Attributes

- · unsigned long init_seed
- · unsigned long cur_seed
- unsigned long num_draws

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

• /home/oohnohnoh1/Desktop/GIT/Research/Parallel/include/random.hpp

3.20 Stack< T, CONT > Class Template Reference

Public Member Functions

- void **push** (T const &)
- void pop ()
- T top () const
- · bool empty () const

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

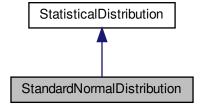
 $\bullet \ \ / home/oohnohnoh1/Desktop/GIT/Research/Parallel/include/openmp_templates.hpp$

3.21 StandardNormalDistribution Class Reference

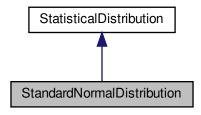
Standard Normal Distribution Implementation.

```
#include <statistics.h>
```

 $Inheritance\ diagram\ for\ Standard Normal Distribution:$



Collaboration diagram for StandardNormalDistribution:



Public Member Functions

- · virtual double pdf (const double &x) const
- virtual double cdf (const double &x) const
- virtual double inv_cdf (const double &quantile) const
- · virtual double mean () const
- · virtual double var () const

Equal to 0.

• virtual double stddev () const

Equal to 1.

virtual void random_draws (const std::vector< double > &uniform_draws, std::vector< double > &dist_← draws)

Variable 1.

3.21.1 Detailed Description

Standard Normal Distribution Implementation.

A more elaborate explanation here

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

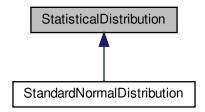
- /home/oohnohnoh1/Desktop/GIT/Research/Parallel/include/statistics.h
- /home/oohnohnoh1/Desktop/GIT/Research/Parallel/src/statistics.cxx

3.22 Statistical Distribution Class Reference

Statistical Distribution Class.

#include <statistics.h>

Inheritance diagram for StatisticalDistribution:



Public Member Functions

• StatisticalDistribution ()

A constructor.

• virtual ~StatisticalDistribution ()

Virtual destructor.

- virtual double pdf (const double &x) const =0
- virtual double cdf (const double &x) const =0
- virtual double inv_cdf (const double &quantile) const =0
- virtual double **mean** () const =0
- virtual double var () const =0

Variable 1.

• virtual double stdev () const =0

Varable 2

virtual void random_draws (const std::vector< double > &uniform_draws, std::vector< double > &dist_← draws)=0

Variable 3.

3.22.1 Detailed Description

Statistical Distribution Class.

We've specified pure virtual methods for the probability density function (pdf), cumulative density function (cdf), inverse cdf (inv_cdf), as well as descriptive statistics functions such as as mean, var (variance) and stdev.

Finally, we have a method that takes in a vector of uniform random variables on the open interval (0,1), then fills a vector of identical length with draws from the distribution

3.22.2 Constructor & Destructor Documentation

3.22.2.1 StatisticalDistribution()

```
StatisticalDistribution::StatisticalDistribution ( )
```

A constructor.

Statistical Distribution.

Statistical Distribution constructor

A more elaborate class definition

3.22.2.2 ∼StatisticalDistribution()

```
StatisticalDistribution::~StatisticalDistribution ( ) [virtual]
```

Virtual destructor.

Constructor.

A more elaborate explanation here

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

- · /home/oohnohnoh1/Desktop/GIT/Research/Parallel/include/statistics.h
- /home/oohnohnoh1/Desktop/GIT/Research/Parallel/src/statistics.cxx

3.23 Str Class Reference

A constructor with a character pointer input.

```
#include <openmp2.hpp>
```

Public Types

- typedef Vec< char >::size_type size_type
- typedef Vec< char >::size_type size_type

Public Member Functions

- Str (size_type n, char c)
- Str (const char *cp)
- template<class In >

Str (In b, In e)

- Str ()
- Str (size_type n, char c)
- Str (const char *cp)

A constructor with a character pointer input.

template<class In >
Str (In b, In e)

create a Str from the range denoted by iterators b and e

3.23 Str Class Reference 21

3.23.1 Detailed Description

A constructor with a character pointer input.

Custom Str class

A numeric progression is a seuqence of numbers, where the value of each number depends on one or more of the previous value.

Objects of built-in types generally behave like values: Whenever we copy an object of such a type, the original and copy have the same value but are otherwise indepedent.

For most of the built-in types, the language also defines a rich set of operators and provides automatic conversions between logically similar types. For example, if we add an int and a double, the compiler automatically converts the int into a double

When we define our own classes, we control the extent to which the resulting objects behave like values. By defining copying and assigning appropriately, the class author an arrange for objects of that class to act like values - that is, the class author can arrange for each object to have state that is independent of any other object.

Our Vec and Student_info classes are examples of types that act like values

We shall see that the class author an also control conversions and related operations on class objects, thereby providing classes whose objects behave even more similarly to objects of built-in types.

Defining a Str class that lets us create objects that behave approproximately as we would like.

3.23.2 Constructor & Destructor Documentation

A constructor with a character pointer input.

create a Str containing n copies of c

Copy constructor

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

- /home/oohnohnoh1/Desktop/GIT/Research/Parallel/src/openmp2.cxx
- /home/oohnohnoh1/Desktop/GIT/Research/Parallel/include/openmp2.hpp

3.24 Student_info Class Reference

Public Member Functions

- Student info (std::istream &is)
- Student_info (const Student_info &)
- Student_info & operator= (const Student_info &)
- std::istream & read (std::istream &)
- std::string **name** () const
- double grade () const

Static Public Member Functions

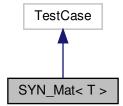
• static bool compare (const Student_info &s1, const Student_info &s2)

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

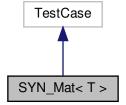
- /home/oohnohnoh1/Desktop/GIT/Research/Parallel/include/Student_info.h
- /home/oohnohnoh1/Desktop/GIT/Research/Parallel/src/Student_info.cxx

3.25 SYN_Mat < T > Class Template Reference

Inheritance diagram for SYN_Mat< T >:



Collaboration diagram for SYN_Mat< T >:



Public Member Functions

- SYN_Mat (unsigned _rows, unsigned _cols, const T &_initial)
- SYN_Mat (const SYN_Mat< T > &alloc)
- SYN_Mat< T > & operator= (const SYN_Mat< T > &alloc)
- SYN_Mat< T > operator+ (const SYN_Mat< T > &rhs)
- SYN Mat< T > & operator+= (const SYN Mat< T > &rhs)
- SYN_Mat< T > operator- (const SYN_Mat< T > &rhs)
- SYN Mat< T > & operator== (const SYN Mat< T > &rhs)
- SYN_Mat< T > operator* (const SYN_Mat< T > &rhs)
- SYN_Mat< T > & operator*= (const SYN_Mat< T > &rhs)
- SYN_Mat< T > transpose ()
- SYN Mat< T > operator+ (const T &rhs)
- SYN Mat< T > operator- (const T &rhs)
- SYN Mat< T > operator* (const T &rhs)
- SYN_Mat< T > operator/ (const T &rhs)
- std::vector< T > operator* (const std::vector< T > &rhs)
- std::vector< T > diag_vec ()
- T & operator() (const unsigned &row, const unsigned &col)
- const T & operator() (const unsigned &row, const unsigned &col) const
- · unsigned get_rows () const
- · unsigned get_cols () const
- · void test1 ()
- · void test2 ()

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

- /home/oohnohnoh1/Desktop/GIT/Research/Parallel/include/openmp_LA.hpp
- /home/oohnohnoh1/Desktop/GIT/Research/Parallel/src/openmp_LA.cxx

3.26 TemplateUnderTest < T > Class Template Reference

Public Member Functions

- TemplateUnderTest (T *t)
- void SomeMethod ()

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

/home/oohnohnoh1/Desktop/GIT/Research/Parallel/include/openmp2.hpp

3.27 Trap Class Reference

Public Member Functions

- void read ()
- void computeTrapezium ()

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

• /home/oohnohnoh1/Desktop/GIT/Research/Parallel/include/trapezoid.hpp

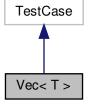
3.28 tutorial::Vec< T > Class Template Reference

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

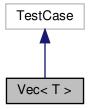
• /home/oohnohnoh1/Desktop/GIT/Research/Parallel/include/lib_mpi.hpp

3.29 Vec < T > Class Template Reference

Inheritance diagram for Vec< T >:



Collaboration diagram for Vec < T >:



Public Types

- typedef T * iterator
- typedef const T * const_iterator
- typedef size_t size_type
- typedef T * iterator
- typedef const T * const_iterator
- typedef size_t size_type
- typedef T value_type
- typedef T & reference
- typedef const T & const_reference

Public Member Functions

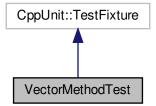
- **Vec** (size_type n, const T &t=T())
- Vec (const Vec &v)
- Vec & operator= (const Vec &)
- const T & operator[] (size_type i) const
- void push_back (const T &t)
- size_type size () const
- iterator **begin** ()
- const_iterator begin () const
- iterator end ()
- · const_iterator end () const
- void runTest ()

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

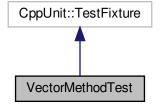
- /home/oohnohnoh1/Desktop/GIT/Research/Parallel/include/MPI_str.hpp
- /home/oohnohnoh1/Desktop/GIT/Research/Parallel/include/openmp1.hpp

3.30 VectorMethodTest Class Reference

Inheritance diagram for VectorMethodTest:



Collaboration diagram for VectorMethodTest:



Public Member Functions

- void setUp ()
- void tearDown ()
- void testConstructor ()

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

• /home/oohnohnoh1/Desktop/GIT/Research/Parallel/include/new.hpp

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