IK SOLVER

PHASE 1

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Chapter 1

Hierarchical Index

1.1 Class Hierarchy

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

Chapter 2

Class Index

2.1 Class List

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

Chapter 3

File Index

3.1 File List

Here is a list of all files with brief descriptions:

Chapter 4

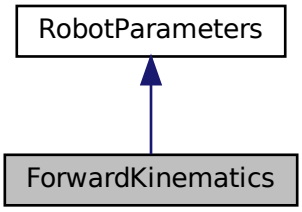
Class Documentation

4.1 ForwardKinematics Class Reference

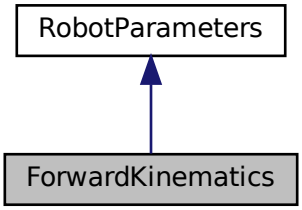
Definition of the Forward Kinematics Class.

`#include <forward_kinematics.hpp>`

Inheritance diagram for ForwardKinematics:



Collaboration diagram for ForwardKinematics:



Public Member Functions

- Eigen::Matrix< double, 4, 4 > calculate_TF (int i)

  Calculate the DH transfromation matrix for each joint pair.
- Eigen::Matrix< double, 4, 4 > solve_fk ()

  Solve the forward kinematics for manipulator.

Additional Inherited Members

4.1.1 Detailed Description

Definition of the Forward Kinematics Class.

4.1.2 Member Function Documentation

4.1.2.1 calculate_TF()

```
Matrix< double, 4, 4 > ForwardKinematics::calculate_TF (
            int i )
```

Calculate the DH transfromation matrix for each joint pair.

Parameters

i	integer value denoting the row of _dh_matrix to be considered

Returns

Eigen::Matrix<double, 4, 4> Returns the transformation matrix

4.1.2.2 solve_fk()

```
Matrix< double, 4, 4 > ForwardKinematics::solve_fk ( )
```

Solve the forward kinematics for manipulator.

Returns

Eigen::Matrix<double, 4, 4> Returns the final Homogeneous transformation matrix

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

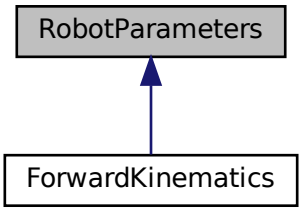
- include/forward_kinematics.hpp
- app/forward_kinematics.cpp

4.2 RobotParameters Class Reference

Definition of the Robot Parameter Class.

`#include <robot_parameters.hpp>`

Inheritance diagram for RobotParameters:



Public Member Functions

- RobotParameters ()

  Construct a new Robot Parameters object to assign default values.
- Eigen::MatrixXd get_dh_parameters ()

  Compute the dh parameters matrix.
- std::vector< double > get_robot_angles ()

  Gets the robot angles.
- void set_robot_angles (std::vector< double > robot_angles)

  Sets the robot angles.

Public Attributes

- std::string robot_name

4.2.1 Detailed Description

Definition of the Robot Parameter Class.

4.2.2 Constructor & Destructor Documentation

4.2.2.1 RobotParameters()

```
RobotParameters::RobotParameters ( )
```

Construct a new Robot Parameters object to assign default values.

4.2.3 Member Function Documentation

4.2.3.1 get_dh_parameters()

```
MatrixXd RobotParameters::get_dh_parameters ( )
```

Compute the dh parameters matrix.

Returns

Eigen::MatrixXd Returns DH matrix

4.2.3.2 get_robot_angles()

```
vector< double > RobotParameters::get_robot_angles ( )
```

Gets the robot angles.

Returns

std::vector<double> Returns the robot angles

4.2.3.3 set_robot_angles()

```
void RobotParameters::set_robot_angles (
            std::vector< double > robot_angles )
```

Sets the robot angles.

Parameters

robot_angles	Sets the robot angles from the ik solver output

4.2.4 Member Data Documentation

4.2.4.1 robot_name

```
std::string RobotParameters::robot_name
```

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

- include/robot_parameters.hpp
- app/robot_parameters.cpp

Chapter 5

File Documentation

5.1 app/CMakeLists.txt File Reference

Functions

- add_executable (ik_solver main.cpp robot_parameters.cpp forward_kinematics.cpp) include_directories($

5.1.1 Function Documentation

5.1.1.1 add_executable()

```
add_executable (
            ik_solver main.cpp robot_parameters.cpp forward_kinematics.  cpp )
```

5.2 test/CMakeLists.txt File Reference

Functions

- set (GTEST_SHUFFLE 1) add_executable(code_test main.cpp code_test.cpp ../app/robot_parameters.cpp ../app/forward_kinematics.cpp) target_include_directories(code_test PUBLIC ../vendor/googletest/googletest/include $

5.2.1 Function Documentation

5.2.1.1 set()

```
set (
            GTEST_SHUFFLE 1 )
```

5.3 app/forward_kinematics.cpp File Reference

Program to define the Methods of Forward Kinematics Class.

```
#include "../include/forward_kinematics.hpp"
#include <iostream>
```

Include dependency graph for forward_kinematics.cpp:

5.3.1 Detailed Description

Program to define the Methods of Forward Kinematics Class.

Author

Driver : Tanmay Haldankar (tanmayh@umd.edu), Navigator: Sanchit Kedia (sanchit@terpmail.↩ umd.edu), Design Keeper: Qamar Syed (qsyed@umd.edu)

Version

0.12

Date

2022-10-18

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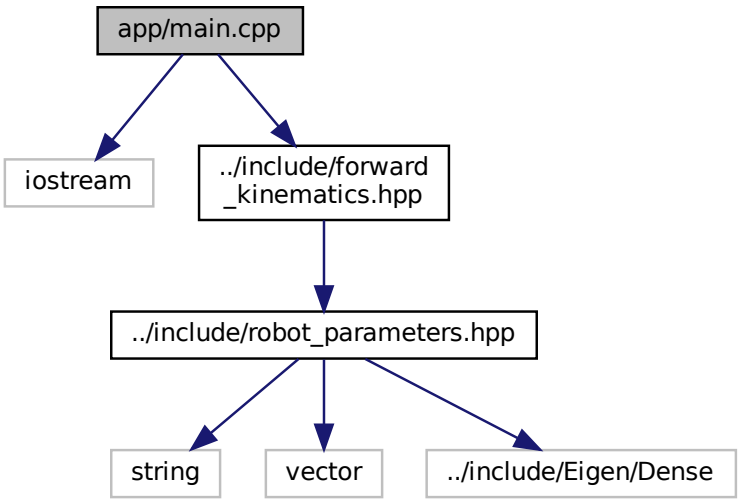
5.4 app/main.cpp File Reference

Program to execute the inverse kinematics and forward kinematics.

```
#include <iostream>
#include "../include/forward_kinematics.hpp"
```

Include dependency graph for main.cpp:



Functions

- int main ()

  Main Function.

5.4.1 Detailed Description

Program to execute the inverse kinematics and forward kinematics.

Author

Driver : Sanchit Kedia (sanchit@terpmail.umd.edu), Navigator: Tanmay Haldankar (tanmayh@umd.edu), Design Keeper: Qamar Syed (qsyed@umd.edu)

Version

0.2

Date

2022-10-18

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5.4.2 Function Documentation

5.4.2.1 main()

```
int main ( )
```

Main Function.

Returns

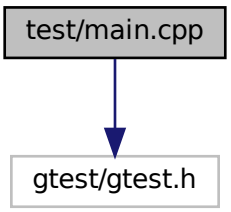
int 0

5.5 test/main.cpp File Reference

Program to use google test for unit testing.

```
#include <gtest/gtest.h>
```

Include dependency graph for main.cpp:



Functions

- int main (int argc, char **argv)

5.5.1 Detailed Description

Program to use google test for unit testing.

Author

Driver : Sanchit Kedia (sanchit@terpmail.umd.edu), Navigator: Tanmay Haldankar (tanmayh@umd.edu), Design Keeper: Qamar Syed (qsyed@umd.edu)

Version

0.1

Date

2022-10-13

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5.5.2 Function Documentation

5.5.2.1 main()

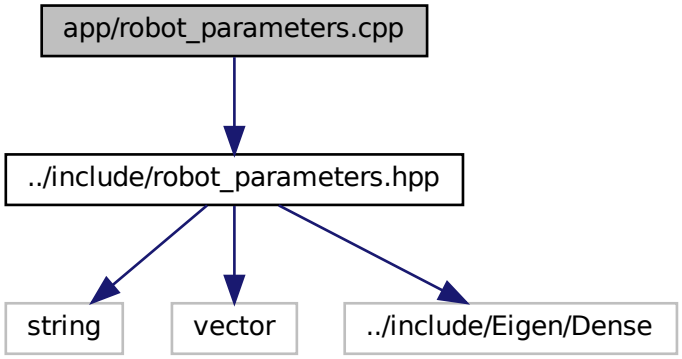
```
int main (
            int argc,
            char ** argv )
```

5.6 app/robot_parameters.cpp File Reference

Program to define the Methods of Robot Parameters Class.

```
#include "../include/robot_parameters.hpp"
```

Include dependency graph for robot_parameters.cpp:



5.6.1 Detailed Description

Program to define the Methods of Robot Parameters Class.

Author

Driver : Sanchit Kedia (sanchit@terpmail.umd.edu), Navigator: Tanmay Haldankar (tanmayh@umd.edu), Design Keeper: Qamar Syed (qsyed@umd.edu)

Version

0.11

Date

2022-10-13

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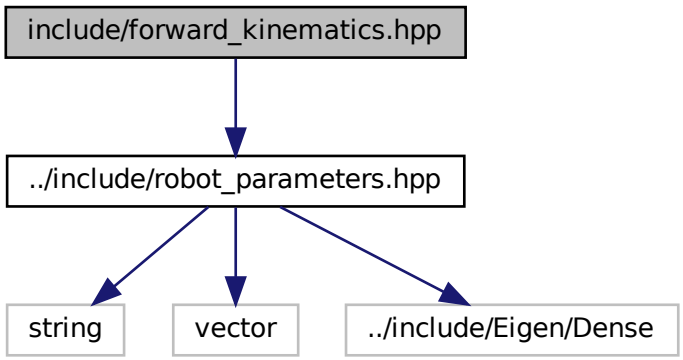
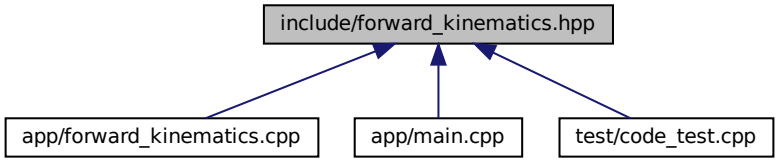
5.7 include/forward_kinematics.hpp File Reference

Definition of Forward Kinematics class and Declaration of its Methods.

`#include "../include/robot_parameters.hpp"`
Include dependency graph for forward_kinematics.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- class ForwardKinematics

  Definition of the Forward Kinematics Class.

5.7.1 Detailed Description

Definition of Forward Kinematics class and Declaration of its Methods.

Author

Driver : Tanmay Haldankar (tanmayh@umd.edu), Navigator: Sanchit Kedia (sanchit@terpmail.↩umd.edu), Design Keeper: Qamar Syed (qsyed@umd.edu)

Version

0.1

Date

2022-10-18

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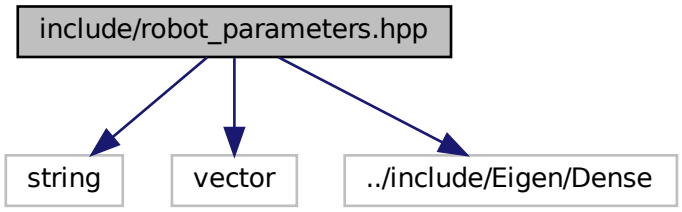
5.8 include/robot_parameters.hpp File Reference

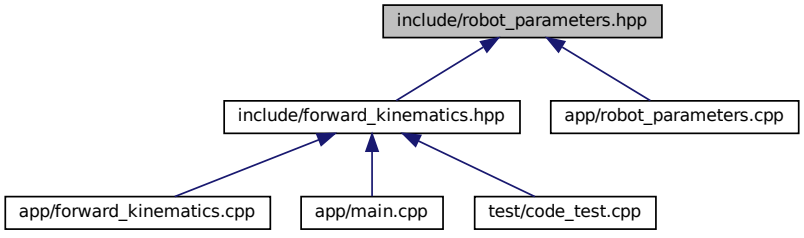
Definition of Robot Parameters class and Declaration of its Methods.

```
#include <string>
#include <vector>
#include "../include/Eigen/Dense"
```

Include dependency graph for robot_parameters.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- class RobotParameters

  Definition of the Robot Parameter Class.

5.8.1 Detailed Description

Definition of Robot Parameters class and Declaration of its Methods.

Author

Driver : Sanchit Kedia (sanchit@terpmail.umd.edu), Navigator: Tanmay Haldankar (tanmayh@umd.edu), Design Keeper: Qamar Syed (qsyed@umd.edu)

Version

0.1

Date

2022-10-15

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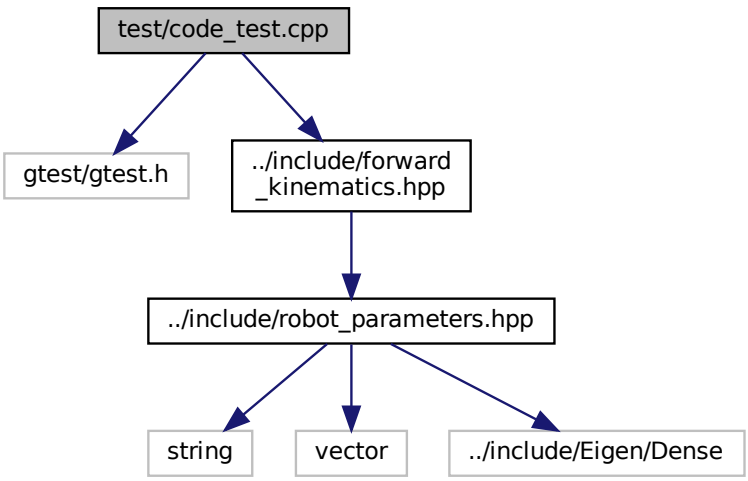
5.9 test/code_test.cpp File Reference

Program to perform unit testing.

```
#include <gtest/gtest.h>
#include "../include/forward_kinematics.hpp"
```

Include dependency graph for code_test.cpp:



Functions

- TEST (Robot_Parameters, CheckAngles)

  Construct a new TEST to check if the robot angles vector is empty.
- TEST (Robot_Parameters, CheckDH)

  Construct a new TEST to check the size of the DH Parameters matrix.
- TEST (Robot_Parameters, CheckSetAngles)

  Construct a new TEST to check if the robot angles are being set correctly.
- TEST (Forward_Kinematics, check_calculateTF)

  Construct a new TEST to check the size of the DH transformation matrix.
- TEST (Forward_Kinematics, check_solvefk)

  Construct a new TEST to check the size of final homogeneous transformation matrix.

5.9.1 Detailed Description

Program to perform unit testing.

Author

Driver : Sanchit Kedia (sanchit@terpmail.umd.edu), Navigator: Tanmay Haldankar (tanmayh@umd.edu), Design Keeper: Qamar Syed (qsyed@umd.edu)

Version

0.3

Date

2022-10-15

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5.9.2 Function Documentation

5.9.2.1 TEST() [1/5]

```
TEST (
            Forward_Kinematics ,
            check_calculateTF  )
```

Construct a new TEST to check the size of the DH transformation matrix.

5.9.2.2 TEST() [2/5]

```
TEST (
            Forward_Kinematics ,
            check_solvefk  )
```

Construct a new TEST to check the size of final homogeneous transformation matrix.

5.9.2.3 TEST() [3/5]

```
TEST (
            Robot_Parameters ,
            CheckAngles  )
```

Construct a new TEST to check if the robot angles vector is empty.

5.9.2.4 TEST() [4/5]

```
TEST (
            Robot_Parameters ,
            CheckDH  )
```

Construct a new TEST to check the size of the DH Parameters matrix.

5.9.2.5 TEST() [5/5]

```
TEST (
            Robot_Parameters ,
            CheckSetAngles  )
```

Construct a new TEST to check if the robot angles are being set correctly.

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