

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:

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ForwardKinematics	7

Chapter 2

Class Index

2.1 Class List

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

ForwardKinematics	
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RobotParameters	
Definition of the Robot Parameter Class	9

Chapter 3

File Index

3.1 File List

Here is a list of all files with brief descriptions:

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Chapter 4

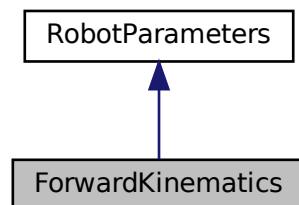
Class Documentation

4.1 ForwardKinematics Class Reference

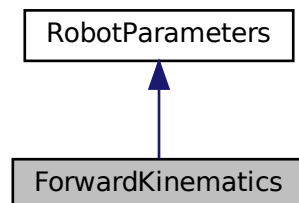
Definition of the Forward Kinematics Class.

```
#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 transformation 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 transformation matrix for each joint pair.

Parameters

<i>i</i>	integer value denoting the row of <code>_dh_matrix</code> 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:

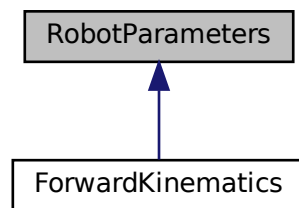
- `include/forward_kinematics.hpp`
- `app/forward_kinematics.cpp`

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

<i>robot_angles</i>	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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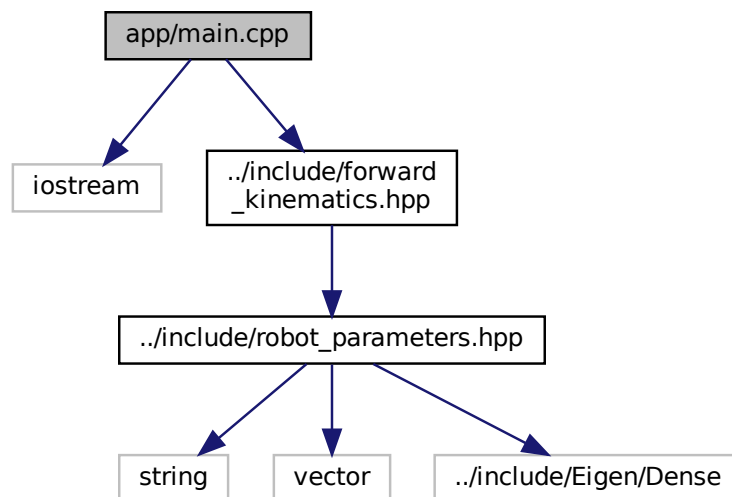
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5.4 app/main.cpp File Reference

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

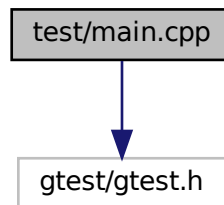
int 0

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()

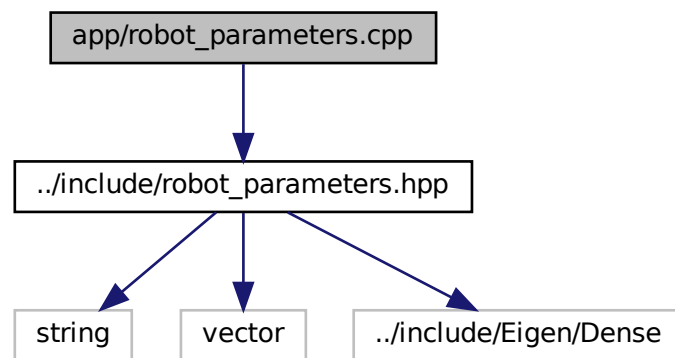
```
int main (
    int argc,
    char ** argv )
```

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

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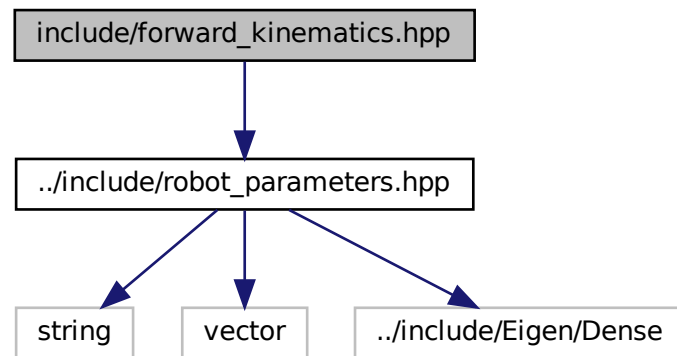
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5.7 include/forward_kinematics.hpp File Reference

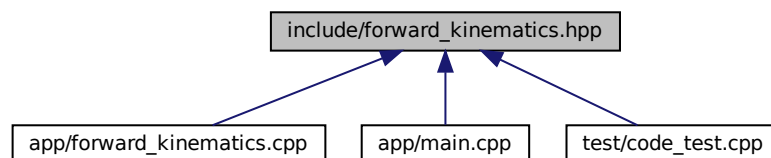
Definition of Forward Kinematics class and Declaration of its Methods.

```
#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

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Date

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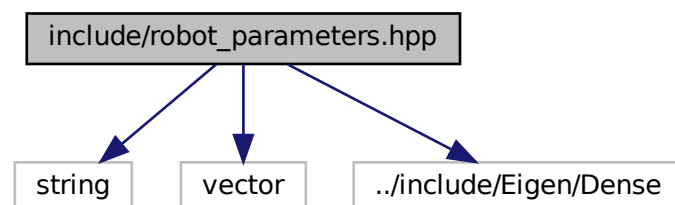
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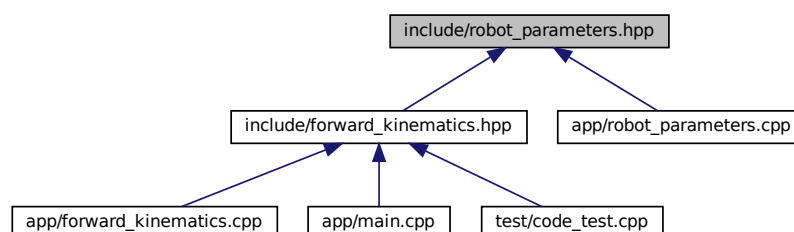
5.8 include/robot_parameters.hpp File Reference

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

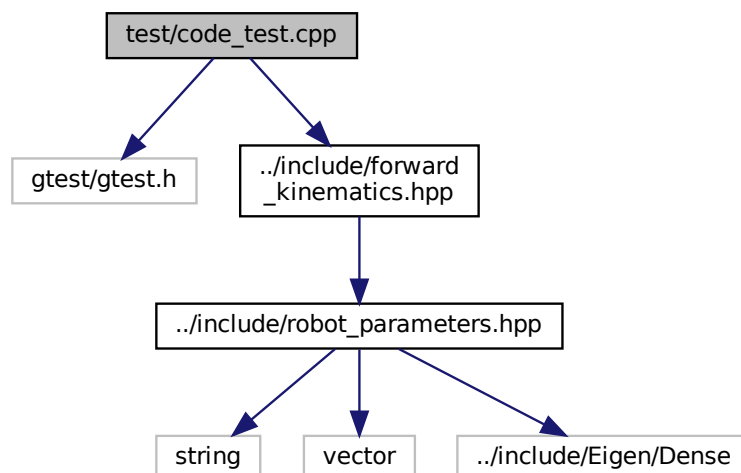
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5.9 test/code_test.cpp File Reference

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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