

UAV common

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Chapter 1

Hierarchical Index

1.1 Class Hierarchy

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Chapter 2

Class Index

2.1 Class List

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

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Chapter 3

File Index

3.1 File List

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Chapter 4

Class Documentation

4.1 AeroCoefficients Struct Reference

Aerodynamic coefficient.

```
#include <aero_coefficients.hpp>
```

Public Attributes

- double [S](#)
- double [d](#)
- double [eAR](#)
- Eigen::Vector< double, 6 > [C0](#)
- Eigen::Matrix< double, 6, 3 > [Cpqr](#)
- Eigen::Matrix< double, 6, 4 > [Cab](#)
- double [stallLimit](#)

4.1.1 Detailed Description

Aerodynamic coefficient.

4.1.2 Member Data Documentation

4.1.2.1 C0

```
Eigen::Vector<double,6> AeroCoefficients::C0
```

4.1.2.2 Cab

```
Eigen::Matrix<double,6,4> AeroCoefficients::Cab
```

4.1.2.3 Cpqr

```
Eigen::Matrix<double,6,3> AeroCoefficients::Cpqr
```

4.1.2.4 d

```
double AeroCoefficients::d
```

4.1.2.5 eAR

```
double AeroCoefficients::eAR
```

4.1.2.6 S

```
double AeroCoefficients::S
```

4.1.2.7 stallLimit

```
double AeroCoefficients::stallLimit
```

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

- [src/components/aero_coefficients.hpp](#)

4.2 AHRSParams Struct Reference

AHRS parameters.

```
#include <navi.hpp>
```

Public Attributes

- std::string [type](#)
- double [alpha](#)
- double [Q](#)
- double [R](#)

4.2.1 Detailed Description

AHRS parameters.

4.2.2 Member Data Documentation

4.2.2.1 [alpha](#)

```
double AHRSPParams::alpha
```

4.2.2.2 [Q](#)

```
double AHRSPParams::Q
```

4.2.2.3 [R](#)

```
double AHRSPParams::R
```

4.2.2.4 [type](#)

```
std::string AHRSPParams::type
```

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

- src/components/[navi.hpp](#)

4.3 Ammo Class Reference

```
#include <loads.hpp>
```

Inheritance diagram for Ammo:

Collaboration diagram for Ammo:

Public Member Functions

- [Ammo](#) ()=default
- [Ammo](#) (int ammount, double [reload](#), Eigen::Vector3d offset, double mass, Eigen::Vector3d V0)
- [Ammo](#) & [operator=](#) (const [Ammo](#) &other)
- Eigen::Vector3d [getV0](#) ()
get start velocity of ammo when launched

Protected Attributes

- Eigen::Vector3d [_V0](#)

Additional Inherited Members

4.3.1 Constructor & Destructor Documentation

4.3.1.1 Ammo() [1/2]

```
Ammo::Ammo ( ) [default]
```

4.3.1.2 Ammo() [2/2]

```
Ammo::Ammo (
    int ammount,
    double reload,
    Eigen::Vector3d offset,
    double mass,
    Eigen::Vector3d V0 )
```

4.3.2 Member Function Documentation

4.3.2.1 getV0()

```
Eigen::Vector3d Ammo::getV0 ( ) [inline]
```

get start velocity of ammo when launched

Returns

start velocity vector

4.3.2.2 operator=()

```
Ammo & Ammo::operator= (
    const Ammo & other )
```

4.3.3 Member Data Documentation

4.3.3.1 _V0

```
Eigen::Vector3d Ammo::_V0 [protected]
```

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

- [src/components/loads.hpp](#)
- [src/components/loads.cpp](#)

4.4 Cargo Class Reference

```
#include <loads.hpp>
```

Inheritance diagram for Cargo:

Collaboration diagram for Cargo:

Public Member Functions

- [Cargo](#) ()=default
- [Cargo](#) (int ammount, double [reload](#), Eigen::Vector3d offset, double mass)

Additional Inherited Members

4.4.1 Constructor & Destructor Documentation

4.4.1.1 Cargo() [1/2]

```
Cargo::Cargo ( ) [default]
```

4.4.1.2 Cargo() [2/2]

```
Cargo::Cargo (
    int ammount,
    double reload,
    Eigen::Vector3d offset,
    double mass )
```

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

- [src/components/loads.hpp](#)
- [src/components/loads.cpp](#)

4.5 ControlSurfaces Class Reference

Aircraft's control surfaces.

```
#include <control_surfaces.hpp>
```

Public Member Functions

- [ControlSurfaces](#) ()
- [ControlSurfaces](#) (int noOfSurfaces, Eigen::Matrix< double, 6,-1 > matrix, Eigen::VectorXd min, Eigen::VectorXd max, Eigen::VectorXd trim)
Constructor.
- Eigen::Vector< double, 6 > [getCoefficients](#) () const
- bool [setValues](#) (Eigen::VectorXd new_values)
- void [restoreTrim](#) ()
- int [getNoOfSurface](#) () const
- Eigen::VectorXd [getValues](#) () const

4.5.1 Detailed Description

Aircraft's control surfaces.

4.5.2 Constructor & Destructor Documentation

4.5.2.1 ControlSurfaces() [1/2]

```
ControlSurfaces::ControlSurfaces ( )
```

4.5.2.2 ControlSurfaces() [2/2]

```
ControlSurfaces::ControlSurfaces (
    int noOfSurfaces,
    Eigen::Matrix< double, 6,-1 > matrix,
    Eigen::VectorXd min,
    Eigen::VectorXd max,
    Eigen::VectorXd trim )
```

Constructor.

Parameters

<i>noOfSurfaces</i>	number of independent surfaces
<i>matrix</i>	coefficients matrix
<i>min</i>	vector of min angles
<i>max</i>	vector of max angles
<i>trim</i>	vector of trim angles

4.5.3 Member Function Documentation

4.5.3.1 getCoefficients()

```
Eigen::Vector< double, 6 > ControlSurfaces::getCoefficients ( ) const
```

4.5.3.2 getNoOfSurface()

```
int ControlSurfaces::getNoOfSurface ( ) const [inline]
```

4.5.3.3 `getValues()`

```
Eigen::VectorXd ControlSurfaces::getValues ( ) const [inline]
```

4.5.3.4 `restoreTrim()`

```
void ControlSurfaces::restoreTrim ( )
```

4.5.3.5 `setValues()`

```
bool ControlSurfaces::setValues (
    Eigen::VectorXd new_values )
```

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

- [src/components/control_surfaces.hpp](#)
- [src/components/control_surfaces.cpp](#)

4.6 Drive Struct Reference

[Drive](#) propelling aircraft.

```
#include <drive.hpp>
```

Inheritance diagram for Drive:

Collaboration diagram for Drive:

Public Attributes

- Eigen::Vector3d [position](#)
- Eigen::Vector3d [axis](#)
- int [noOfHinges](#)
- [Hinge](#) [hinges](#) [2]

4.6.1 Detailed Description

[Drive](#) propelling aircraft.

4.6.2 Member Data Documentation

4.6.2.1 axis

```
Eigen::Vector3d Drive::axis
```

4.6.2.2 hinges

```
Hinge Drive::hinges[2]
```

4.6.2.3 noOfHinges

```
int Drive::noOfHinges
```

4.6.2.4 position

```
Eigen::Vector3d Drive::position
```

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

- [src/components/drive.hpp](#)

4.7 EKFSalers Struct Reference

Scalers for EKF.

```
#include <navi.hpp>
```

Public Attributes

- double [predictScaler](#)
- double [updateScaler](#)
- double [baroScaler](#)
- double [zScaler](#)

4.7.1 Detailed Description

Scalers for EKF.

4.7.2 Member Data Documentation

4.7.2.1 baroScaler

```
double EKFScalers::baroScaler
```

4.7.2.2 predictScaler

```
double EKFScalers::predictScaler
```

4.7.2.3 updateScaler

```
double EKFScalers::updateScaler
```

4.7.2.4 zScaler

```
double EKFScalers::zScaler
```

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

- [src/components/navi.hpp](#)

4.8 Hinge Class Reference

[Hinge](#) connecting aircraft with drives.

```
#include <hinge.hpp>
```

Public Member Functions

- [Hinge](#) ()=default
- [Hinge](#) (Eigen::Vector3d axis, double max, double min, double trim)
- [Hinge](#) (const [Hinge](#) &old)
- [Hinge](#) & [operator=](#) (const [Hinge](#) &old)
- void [updateValue](#) (double newValue)
set new angle on hinge
- const Eigen::Matrix3d [getRot](#) ()
Get rotation matrix of orientation change due to hinge.

4.8.1 Detailed Description

[Hinge](#) connecting aircraft with drives.

4.8.2 Constructor & Destructor Documentation

4.8.2.1 Hinge() [1/3]

```
Hinge::Hinge ( ) [default]
```

4.8.2.2 Hinge() [2/3]

```
Hinge::Hinge (
    Eigen::Vector3d axis,
    double max,
    double min,
    double trim )
```

4.8.2.3 Hinge() [3/3]

```
Hinge::Hinge (
    const Hinge & old )
```

4.8.3 Member Function Documentation

4.8.3.1 getRot()

```
const Eigen::Matrix3d Hinge::getRot ( )
```

Get rotation matrix of orientation change due to hinge.

Returns

rotation matrix

4.8.3.2 operator=()

```
Hinge & Hinge::operator= (
    const Hinge & old )
```

4.8.3.3 updateValue()

```
void Hinge::updateValue (
    double newValue )
```

set new angle on hinge

Parameters

<i>newValue</i>	new angle of hinge
-----------------	--------------------

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

- [src/components/hinge.hpp](#)
- [src/components/hinge.cpp](#)

4.9 Jet Class Reference

[Jet](#) rocket engine.

```
#include <drive.hpp>
```

Inheritance diagram for Jet:

Collaboration diagram for Jet:

Public Member Functions

- bool [start](#) (double [time](#))
start jet engine
- double [getThrust](#) (double [time](#))
get thrust in specific time
- double [getLastThrust](#) ()
get last calculated thrust

Public Attributes

- int [phases](#)
- Eigen::VectorXd [thrust](#)
- Eigen::VectorXd [time](#)

4.9.1 Detailed Description

[Jet](#) rocket engine.

4.9.2 Member Function Documentation

4.9.2.1 getLastThrust()

```
double Jet::getLastThrust ( ) [inline]
```

get last calculated thrust

Returns

last calculated thrust

4.9.2.2 getThrust()

```
double Jet::getThrust (
    double time )
```

get thrust in specific time

Parameters

<i>time</i>	timestamp
-------------	-----------

Returns

thrust value in Newtons

4.9.2.3 start()

```
bool Jet::start (
    double time )
```

start jet engine

Parameters

<i>time</i>	timestamp of start
-------------	--------------------

Returns

true if start succesful, false if already started

4.9.3 Member Data Documentation

4.9.3.1 phases

```
int Jet::phases
```

4.9.3.2 thrust

```
Eigen::VectorXd Jet::thrust
```

4.9.3.3 time

```
Eigen::VectorXd Jet::time
```

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

- [src/components/drive.hpp](#)
- [src/components/drive.cpp](#)

4.10 Load Class Reference

[Load](#) of aircraft that can be dropped or launched.

```
#include <loads.hpp>
```

Inheritance diagram for Load:

Public Member Functions

- double [getMass](#) ()
get mass of load
- Eigen::Vector3d [getOffset](#) ()
get offset of load
- int [release](#) (double time)
Try to release load.

Protected Member Functions

- [Load](#) ()=default
- [Load](#) (int ammount, double [reload](#), Eigen::Vector3d offset, double mass)
- [Load](#) & [operator=](#) (const [Load](#) &other)

4.10.1 Detailed Description

[Load](#) of aircraft that can be dropped or launched.

4.10.2 Constructor & Destructor Documentation

4.10.2.1 Load() [1/2]

```
Load::Load ( ) [protected], [default]
```

4.10.2.2 Load() [2/2]

```
Load::Load (
    int ammount,
    double reload,
    Eigen::Vector3d offset,
    double mass ) [protected]
```

4.10.3 Member Function Documentation

4.10.3.1 getMass()

```
double Load::getMass ( ) [inline]
```

get mass of load

Returns

mass

4.10.3.2 getOffset()

```
Eigen::Vector3d Load::getOffset ( ) [inline]
```

get offset of load

Returns

offset vector

4.10.3.3 operator=()

```
Load & Load::operator= (
    const Load & other )    [protected]
```

4.10.3.4 release()

```
int Load::release (
    double time )
```

Try to release load.

Parameters

<i>time</i>	
-------------	--

Returns

leftover ammount of loads. Return -1 if load is not ready and -2 if out of load

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

- [src/components/loads.hpp](#)
- [src/components/loads.cpp](#)

4.11 Logger Class Reference

Log vector data with timestamp in file.

```
#include <logger.hpp>
```

Public Member Functions

- [Logger](#) (std::string path, std::string fmt="", uint8_t group=0)
Constructor.
- [~Logger](#) ()
Destructor.
- void [setFmt](#) (std::string fmt)
Set new format if was not known in constructor.
- void [log](#) (double time, std::initializer_list< Eigen::VectorXd > args)
Log one row.
- void [log](#) (double time, std::initializer_list< double > args)
Log one row.

Static Public Member Functions

- static void [setLogDirectory](#) (std::string subdirectory)

Set global path that log should be created at. Path will be added to relative path of specific log instance.

4.11.1 Detailed Description

Log vector data with timestamp in file.

4.11.2 Constructor & Destructor Documentation

4.11.2.1 [Logger\(\)](#)

```
Logger::Logger (
    std::string path,
    std::string fmt = "",
    uint8_t group = 0 )
```

Constructor.

Parameters

<i>path</i>	relative path with log file name.
<i>fmt</i>	format - information about log structure. First line in log file
<i>group</i>	log group - log will be created only if group is in actual <code>LOGGER_MASK</code>

4.11.2.2 [~Logger\(\)](#)

```
Logger::~~Logger ( )
```

Destructor.

4.11.3 Member Function Documentation

4.11.3.1 [log\(\)](#) [1/2]

```
void Logger::log (
    double time,
    std::initializer_list< double > args )
```

Log one row.

Parameters

<i>time</i>	timestamp
<i>args</i>	list of doubles

4.11.3.2 log() [2/2]

```
void Logger::log (
    double time,
    std::initializer_list< Eigen::VectorXd > args )
```

Log one row.

Parameters

<i>time</i>	timestamp
<i>args</i>	list of double vectors

4.11.3.3 setFmt()

```
void Logger::setFmt (
    std::string fmt )
```

Set new format if was not known in constructor.

Parameters

<i>fmt</i>	new format
------------	------------

4.11.3.4 setLogDirectory()

```
void Logger::setLogDirectory (
    std::string subdirectory ) [static]
```

Set global path that log should be created at. Path will be added to relative path of specific log instance.

Parameters

<i>subdirectory</i>	new global log path
---------------------	---------------------

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

- [src/logger/logger.hpp](#)
- [src/logger/logger.cpp](#)

4.12 ODE Class Reference

Ordinal differential equation solver.

```
#include <ode.hpp>
```

Inheritance diagram for ODE:

Public Types

- enum [ODEMethod](#) { [Euler](#) , [Heun](#) , [RK4](#) , [NONE](#) }
- Supported solving method.*

Public Member Functions

- [ODE](#) (int micro_steps)
Constructor.
- virtual [~ODE](#) ()
Virtual destructor.
- virtual Eigen::VectorXd [step](#) (double t, Eigen::VectorXd y0, std::function< Eigen::VectorXd(double, Eigen::VectorXd)> rhs_fun, double h)=0
One step of explicit solving algorithm.
- int [getMicrosteps](#) () const
Return microsteps - number of rhs function calls to calculate on step.

Static Public Member Functions

- static [ODEMethod fromString](#) (std::string str)
Parse solving method from string.
- static std::unique_ptr< [ODE](#) > [factory](#) ([ODEMethod](#) method)
Factory constructing [ODE](#) solvers.
- static int [getMicrosteps](#) ([ODEMethod](#) method)
Get microsteps of given method.

4.12.1 Detailed Description

Ordinal differential equation solver.

4.12.2 Member Enumeration Documentation

4.12.2.1 ODEMethod

```
enum ODE::ODEMethod
```

Supported solving method.

Enumerator

Euler	
Heun	
RK4	
NONE	

4.12.3 Constructor & Destructor Documentation

4.12.3.1 ODE()

```
ODE::ODE (
    int micro_steps )
```

Constructor.

4.12.3.2 ~ODE()

```
virtual ODE::~~ODE ( ) [inline], [virtual]
```

Virtual destructor.

4.12.4 Member Function Documentation

4.12.4.1 factory()

```
std::unique_ptr< ODE > ODE::factory (
    ODEMethod method ) [static]
```

Factory constructing ODE solvers.

Parameters

<i>method</i>	type of desired method
---------------	------------------------

Returns

instance of ODE solver

4.12.4.2 fromString()

```
ODE::ODEMethod ODE::fromString (
    std::string str ) [static]
```

Parse solving method from string.

Parameters

<i>str</i>	input string
------------	--------------

Returns

solving method if parsed, NONE if unknown

4.12.4.3 getMicrosteps() [1/2]

```
int ODE::getMicrosteps ( ) const
```

Return microsteps - number of rhs function calls to calculate on step.

Returns

microsteps

4.12.4.4 getMicrosteps() [2/2]

```
int ODE::getMicrosteps (
    ODEMethod method ) [static]
```

Get microsteps of given method.

Parameters

<i>method</i>	method type
---------------	-------------

Returns

number of microstep in one algorithm step

4.12.4.5 step()

```
virtual Eigen::VectorXd ODE::step (
    double t,
    Eigen::VectorXd y0,
    std::function< Eigen::VectorXd(double, Eigen::VectorXd)> rhs_fun,
    double h ) [pure virtual]
```

One step of explicit solving algorithm.

Parameters

<i>t</i>	start time
<i>y0</i>	start variable
<i>rhs_fun</i>	right-hand-side function, calculation of derivative
<i>h</i>	time step

Returns

Implemented in [ODE_RK4](#), [ODE_Heun](#), and [ODE_Euler](#).

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

- [src/ode/ode.hpp](#)
- [src/ode/ode.cpp](#)

4.13 ODE_Euler Class Reference

Explicit Euler algorithm.

```
#include <ode_impl.hpp>
```

Inheritance diagram for ODE_Euler:

Collaboration diagram for ODE_Euler:

Public Member Functions

- [ODE_Euler](#) ()
- Eigen::VectorXd [step](#) (double t, Eigen::VectorXd y0, std::function< Eigen::VectorXd(double, Eigen::VectorXd)> rhs_fun, double h) override
One step of explicit solving algorithm.

Additional Inherited Members

4.13.1 Detailed Description

Explicit Euler algorithm.

4.13.2 Constructor & Destructor Documentation

4.13.2.1 ODE_Euler()

```
ODE_Euler::ODE_Euler ( ) [inline]
```

4.13.3 Member Function Documentation

4.13.3.1 step()

```
Eigen::VectorXd ODE_Euler::step (
    double t,
    Eigen::VectorXd y0,
    std::function< Eigen::VectorXd(double, Eigen::VectorXd)> rhs_fun,
    double h ) [inline], [override], [virtual]
```

One step of explicit solving algorithm.

Parameters

<i>t</i>	start time
<i>y0</i>	start variable
<i>rhs_fun</i>	right-hand-side function, calculation of derivative
<i>h</i>	time step

Returns

Implements [ODE](#).

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

- [src/ode/ode_impl.hpp](#)

4.14 ODE_Heun Class Reference

Second order explicit Heun algorithm.

```
#include <ode_impl.hpp>
```

Inheritance diagram for ODE_Heun:

Collaboration diagram for ODE_Heun:

Public Member Functions

- [ODE_Heun](#) ()
- Eigen::VectorXd [step](#) (double t, Eigen::VectorXd y0, std::function< Eigen::VectorXd(double, Eigen::VectorXd)> rhs_fun, double h) override
One step of explicit solving algorithm.

Additional Inherited Members

4.14.1 Detailed Description

Second order explicit Heun algorithm.

4.14.2 Constructor & Destructor Documentation

4.14.2.1 ODE_Heun()

```
ODE_Heun::ODE_Heun ( ) [inline]
```

4.14.3 Member Function Documentation

4.14.3.1 step()

```
Eigen::VectorXd ODE_Heun::step (
    double t,
    Eigen::VectorXd y0,
    std::function< Eigen::VectorXd(double, Eigen::VectorXd)> rhs_fun,
    double h ) [inline], [override], [virtual]
```

One step of explicit solving algorithm.

Parameters

<i>t</i>	start time
<i>y0</i>	start variable
<i>rhs_fun</i>	right-hand-side function, calculation of derivative
<i>h</i>	time step

Returns

Implements [ODE](#).

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

- [src/ode/ode_impl.hpp](#)

4.15 ODE_RK4 Class Reference

Fourth order Runge Kutta algorithm.

```
#include <ode_impl.hpp>
```

Inheritance diagram for ODE_RK4:

Collaboration diagram for ODE_RK4:

Public Member Functions

- [ODE_RK4](#) ()
- [Eigen::VectorXd step](#) (double t, Eigen::VectorXd y0, std::function< Eigen::VectorXd(double, Eigen::VectorXd)> rhs_fun, double h) override
One step of explicit solving algorithm.

Additional Inherited Members

4.15.1 Detailed Description

Fourth order Runge Kutta algorithm.

4.15.2 Constructor & Destructor Documentation

4.15.2.1 ODE_RK4()

```
ODE_RK4::ODE_RK4 ( ) [inline]
```

4.15.3 Member Function Documentation

4.15.3.1 step()

```
Eigen::VectorXd ODE_RK4::step (
    double t,
    Eigen::VectorXd y0,
    std::function< Eigen::VectorXd(double, Eigen::VectorXd)> rhs_fun,
    double h ) [inline], [override], [virtual]
```

One step of explicit solving algorithm.

Parameters

<i>t</i>	start time
<i>y0</i>	start variable
<i>rhs_fun</i>	right-hand-side function, calculation of derivative
<i>h</i>	time step

Returns

Implements [ODE](#).

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

- [src/ode/ode_impl.hpp](#)

4.16 ODETest Class Reference

Inheritance diagram for ODETest:

Collaboration diagram for ODETest:

Protected Member Functions

- void [SetUp](#) () override
- void [TearDown](#) () override

4.16.1 Member Function Documentation

4.16.1.1 SetUp()

```
void ODETest::SetUp ( ) [inline], [override], [protected]
```

4.16.1.2 TearDown()

```
void ODETest::TearDown ( ) [inline], [override], [protected]
```

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

- [src/ode/ode_test.cpp](#)

4.17 PID Class Reference

PID discrete controller.

```
#include <PID.hpp>
```

Public Member Functions

- [PID](#) (double Kp, double Ki, double Kd, double min=std::numeric_limits< double >::min(), double max=std::numeric_limits< double >::max(), [AntiWindUpMode](#) antiWindUp=[AntiWindUpMode::Clamping](#))
- [~PID](#) ()
- void [set_dt](#) (double dt)
Set new time step.
- double [calc](#) (double error)
calc output of controller
- double [calc](#) (double error, double dt)
calc output of controller with specific time step
- void [clear](#) ()
clear internal state

4.17.1 Detailed Description

PID discrete controller.

4.17.2 Constructor & Destructor Documentation

4.17.2.1 PID()

```
PID::PID (
    double Kp,
    double Ki,
    double Kd,
    double min = std::numeric_limits<double>::min(),
    double max = std::numeric_limits<double>::max(),
    AntiWindUpMode antiWindUp = AntiWindUpMode::Clamping )
```

4.17.2.2 ~PID()

```
PID::~~PID ( )
```

4.17.3 Member Function Documentation

4.17.3.1 calc() [1/2]

```
double PID::calc (
    double error )
```

calc output of controller

Parameters

<i>error</i>	input of controller
--------------	---------------------

Returns

output of controller

4.17.3.2 calc() [2/2]

```
double PID::calc (
    double error,
    double dt )
```

calc output of controller with specific time step

Parameters

<i>error</i>	input of controller
<i>dt</i>	time step

Returns

output of controller

4.17.3.3 clear()

```
void PID::clear ( )
```

clear internal state

4.17.3.4 set_dt()

```
void PID::set_dt (
    double dt )
```

Set new time step.

Parameters

<i>dt</i>	new time step
-----------	---------------

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

- [src/PID/PID.hpp](#)
- [src/PID/PID.cpp](#)

4.18 Rotor Struct Reference

[Rotor](#) engine with controlled speed.

```
#include <drive.hpp>
```

Inheritance diagram for Rotor:

Collaboration diagram for Rotor:

Public Attributes

- double [forceCoff](#)
- double [torqueCoff](#)
- int [direction](#)
- double [timeConstant](#)
- double [maxSpeed](#)
- double [hoverSpeed](#)

4.18.1 Detailed Description

[Rotor](#) engine with controlled speed.

4.18.2 Member Data Documentation

4.18.2.1 direction

```
int Rotor::direction
```

4.18.2.2 forceCoff

```
double Rotor::forceCoff
```

4.18.2.3 hoverSpeed

```
double Rotor::hoverSpeed
```

4.18.2.4 maxSpeed

```
double Rotor::maxSpeed
```

4.18.2.5 timeConstant

```
double Rotor::timeConstant
```

4.18.2.6 torqueCoff

```
double Rotor::torqueCoff
```

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

- [src/components/drive.hpp](#)

4.19 SensorParams Struct Reference

Base parameters of a sensor.

```
#include <navi.hpp>
```

Public Attributes

- `std::string` [name](#)
- `double` [sd](#)
- `Eigen::Vector3d` [bias](#)
- `double` [refreshTime](#)

4.19.1 Detailed Description

Base parameters of a sensor.

4.19.2 Member Data Documentation

4.19.2.1 bias

```
Eigen::Vector3d SensorParams::bias
```

4.19.2.2 name

```
std::string SensorParams::name
```

4.19.2.3 refreshTime

```
double SensorParams::refreshTime
```

4.19.2.4 sd

```
double SensorParams::sd
```

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

- [src/components/navi.hpp](#)

4.20 TimedLoop Class Reference

Simulation of real-time synchronized loop.

```
#include <timed_loop.hpp>
```

Public Member Functions

- [TimedLoop](#) (int periodInMs, std::function< void(void)> func, [Status](#) &status)
Constructor.
- void [go](#) ()
start infinite loop
- void [go](#) (uint32_t loops)
start loop for specific cycle numbers

4.20.1 Detailed Description

Simulation of real-time synchronized loop.

4.20.2 Constructor & Destructor Documentation

4.20.2.1 TimedLoop()

```
TimedLoop::TimedLoop (
    int periodInMs,
    std::function< void(void)> func,
    Status & status )
```

Constructor.

Parameters

<i>periodInMs</i>	loop period in milliseconds
<i>func</i>	function that should be called in loop
<i>status</i>	reference to controlling status

4.20.3 Member Function Documentation

4.20.3.1 go() [1/2]

```
void TimedLoop::go ( )
```

start infinite loop

4.20.3.2 go() [2/2]

```
void TimedLoop::go (
    uint32_t loops )
```

start loop for specific cycle numbers

Parameters

<i>loops</i>	how many cycles should be done
--------------	--------------------------------

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

- [src/timed_loop/timed_loop.hpp](#)
- [src/timed_loop/timed_loop.cpp](#)

4.21 UAVparams Struct Reference

Parsed UAV configuration from XML.

```
#include <uav_params.hpp>
```

Collaboration diagram for UAVparams:

Public Member Functions

- [UAVparams](#) ()
Initialize default data.
- [~UAVparams](#) ()
- void [loadConfig](#) (std::string configFile)
- Eigen::VectorXd [getRotorTimeConstants](#) () const
- Eigen::VectorXd [getRotorMaxSpeeds](#) () const
- Eigen::VectorXd [getRotorHoverSpeeds](#) () const

Static Public Member Functions

- static const [UAVparams](#) * [getSingleton](#) ()

Public Attributes

- std::string [name](#)
- bool [instantRun](#)
- std::string [initialMode](#)
- Eigen::Vector3d [initialPosition](#)
- Eigen::Vector3d [initialOrientation](#)
- Eigen::Vector3d [initialVelocity](#)
- double [m](#)
- double [lx](#)
- double [ly](#)
- double [lz](#)
- double [lxy](#)
- double [lxz](#)
- double [lyz](#)
- int [noOfRotors](#)
- std::unique_ptr< [Rotor](#)[]> [rotors](#)
- int [noOfJets](#)
- std::unique_ptr< [Jet](#)[]> [jets](#)
- [ControlSurfaces](#) [surfaces](#)
- [AeroCoefficients](#) [aero_coffs](#)
- std::map< std::string, [PID](#) > [pids](#)
- std::vector< [SensorParams](#) > [sensors](#)
- [AHRSParms](#) [ahrs](#)
- [EKFSalers](#) [ekf](#)
- Eigen::MatrixX4d [rotorMixer](#)
- Eigen::MatrixX4d [surfaceMixer](#)
- int [noOfAmmo](#)
- std::unique_ptr< [Ammo](#)[]> [ammo](#)
- int [noOfCargo](#)
- std::unique_ptr< [Cargo](#)[]> [cargo](#)

4.21.1 Detailed Description

Parsed UAV configuration from XML.

4.21.2 Constructor & Destructor Documentation

4.21.2.1 UAVparams()

```
UAVparams::UAVparams ( )
```

Initialize default data.

4.21.2.2 ~UAVparams()

```
UAVparams::~~UAVparams ( )
```

4.21.3 Member Function Documentation

4.21.3.1 getRotorHoverSpeeds()

```
Eigen::VectorXd UAVparams::getRotorHoverSpeeds ( ) const
```

4.21.3.2 getRotorMaxSpeeds()

```
Eigen::VectorXd UAVparams::getRotorMaxSpeeds ( ) const
```

4.21.3.3 getRotorTimeContants()

```
Eigen::VectorXd UAVparams::getRotorTimeContants ( ) const
```

4.21.3.4 `getSingleton()`

```
const UAVparams * UAVparams::getSingleton ( ) [static]
```

4.21.3.5 `loadConfig()`

```
void UAVparams::loadConfig (
    std::string configFile )
```

4.21.4 Member Data Documentation

4.21.4.1 `aero_coffs`

```
AeroCoefficients UAVparams::aero_coffs
```

4.21.4.2 `ahrs`

```
AHRSParams UAVparams::ahrs
```

4.21.4.3 `ammo`

```
std::unique_ptr<Ammo[ ]> UAVparams::ammo
```

4.21.4.4 `cargo`

```
std::unique_ptr<Cargo[ ]> UAVparams::cargo
```

4.21.4.5 `ekf`

```
EKFScalers UAVparams::ekf
```

4.21.4.6 initialMode

`std::string UAVparams::initialMode`

4.21.4.7 initialOrientation

`Eigen::Vector3d UAVparams::initialOrientation`

4.21.4.8 initialPosition

`Eigen::Vector3d UAVparams::initialPosition`

4.21.4.9 initialVelocity

`Eigen::Vector3d UAVparams::initialVelocity`

4.21.4.10 instantRun

`bool UAVparams::instantRun`

4.21.4.11 Ix

`double UAVparams::Ix`

4.21.4.12 Ixy

`double UAVparams::Ixy`

4.21.4.13 Ixz

`double UAVparams::Ixz`

4.21.4.14 ly

```
double UAVparams::Iy
```

4.21.4.15 Iyz

```
double UAVparams::Iyz
```

4.21.4.16 Iz

```
double UAVparams::Iz
```

4.21.4.17 jets

```
std::unique_ptr<Jet[]> UAVparams::jets
```

4.21.4.18 m

```
double UAVparams::m
```

4.21.4.19 name

```
std::string UAVparams::name
```

4.21.4.20 noOfAmmo

```
int UAVparams::noOfAmmo
```

4.21.4.21 noOfCargo

```
int UAVparams::noOfCargo
```

4.21.4.22 noOfJets

```
int UAVparams::noOfJets
```

4.21.4.23 noOfRotors

```
int UAVparams::noOfRotors
```

4.21.4.24 pids

```
std::map<std::string, PID> UAVparams::pids
```

4.21.4.25 rotorMixer

```
Eigen::MatrixX4d UAVparams::rotorMixer
```

4.21.4.26 rotors

```
std::unique_ptr<Rotor[]> UAVparams::rotors
```

4.21.4.27 sensors

```
std::vector<SensorParams> UAVparams::sensors
```

4.21.4.28 surfaceMixer

```
Eigen::MatrixX4d UAVparams::surfaceMixer
```

4.21.4.29 surfaces

```
ControlSurfaces UAVparams::surfaces
```

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

- [src/parser/uav_params.hpp](#)
- [src/parser/uav_params.cpp](#)

Chapter 5

File Documentation

5.1 header/common.hpp File Reference

```
#include "../src/logger/logger.hpp"
#include "../src/ode/ode.hpp"
#include "../src/PID/PID.hpp"
#include "../src/timed_loop/timed_loop.hpp"
#include "../src/timed_loop/status.hpp"
#include "../src/parser/parser.hpp"
#include "../src/parser/uav_params.hpp"
#include "../src/components/components.hpp"
Include dependency graph for common.hpp:
```

5.2 src/components/aero_coefficients.hpp File Reference

```
#include <Eigen/Dense>
```

Include dependency graph for aero_coefficients.hpp: This graph shows which files directly or indirectly include this file:

Classes

- struct [AeroCoefficients](#)
Aerodynamic coefficient.

5.3 src/components/components.hpp File Reference

```
#include "drive.hpp"
#include "control_surfaces.hpp"
#include "aero_coefficients.hpp"
#include "loads.hpp"
#include "navi.hpp"
```

Include dependency graph for components.hpp: This graph shows which files directly or indirectly include this file:

5.4 src/components/control_surfaces.cpp File Reference

```
#include "control_surfaces.hpp"
```

Include dependency graph for control_surfaces.cpp:

5.5 src/components/control_surfaces.hpp File Reference

```
#include <Eigen/Dense>
```

Include dependency graph for control_surfaces.hpp: This graph shows which files directly or indirectly include this file:

Classes

- class [ControlSurfaces](#)
Aircraft's control surfaces.

5.6 src/components/drive.cpp File Reference

```
#include "drive.hpp"
```

Include dependency graph for drive.cpp:

5.7 src/components/drive.hpp File Reference

```
#include <Eigen/Dense>
```

```
#include "hinge.hpp"
```

Include dependency graph for drive.hpp: This graph shows which files directly or indirectly include this file:

Classes

- struct [Drive](#)
Drive propelling aircraft.
- struct [Rotor](#)
Rotor engine with controlled speed.
- class [Jet](#)
Jet rocket engine.

5.8 src/components/hinge.cpp File Reference

```
#include "hinge.hpp"
```

Include dependency graph for hinge.cpp:

Functions

- `Eigen::Matrix3d` [asSkewMatrix](#) (`Eigen::Vector3d v`)

5.8.1 Function Documentation

5.8.1.1 asSkewMatrix()

```
Eigen::Matrix3d asSkewMatrix (  
    Eigen::Vector3d v )
```

5.9 src/components/hinge.hpp File Reference

```
#include <Eigen/Dense>  
#include <mutex>  
#include <memory>
```

Include dependency graph for hinge.hpp: This graph shows which files directly or indirectly include this file:

Classes

- class [Hinge](#)
[Hinge](#) connecting aircraft with drives.

5.10 src/components/loads.cpp File Reference

```
#include "loads.hpp"  
#include <limits>
```

Include dependency graph for loads.cpp:

5.11 src/components/loads.hpp File Reference

```
#include <Eigen/Dense>  
#include <atomic>
```

Include dependency graph for loads.hpp: This graph shows which files directly or indirectly include this file:

Classes

- class [Load](#)
[Load](#) of aircraft that can be dropped or launched.
- class [Ammo](#)
- class [Cargo](#)

5.12 src/components/navi.hpp File Reference

```
#include <Eigen/Dense>
```

Include dependency graph for navi.hpp: This graph shows which files directly or indirectly include this file:

Classes

- struct [SensorParams](#)
Base parameters of a sensor.
- struct [AHRSParams](#)
AHRS parameters.
- struct [EKFScalers](#)
Scalers for EKF.

5.13 src/logger/logger.cpp File Reference

```
#include "logger.hpp"  
#include <Eigen/Dense>  
#include <iostream>  
#include <fstream>  
#include <initializer_list>  
#include <string>  
#include <filesystem>
```

Include dependency graph for logger.cpp:

Functions

- bool [shouldLog](#) (uint8_t group)

5.13.1 Function Documentation

5.13.1.1 shouldLog()

```
bool shouldLog (  
    uint8_t group )
```

5.14 src/logger/logger.hpp File Reference

```
#include <Eigen/Dense>  
#include <iostream>  
#include <fstream>  
#include <initializer_list>  
#include <string>  
#include <filesystem>
```

Include dependency graph for logger.hpp: This graph shows which files directly or indirectly include this file:

Classes

- class [Logger](#)
Log vector data with timestamp in file.

Macros

- #define [LOGGER_MASK](#) -1

5.14.1 Macro Definition Documentation

5.14.1.1 [LOGGER_MASK](#)

```
#define LOGGER\_MASK -1
```

5.15 src/ode/ode.cpp File Reference

```
#include "ode.hpp"  
#include "ode_impl.hpp"  
Include dependency graph for ode.cpp:
```

5.16 src/ode/ode.hpp File Reference

```
#include <functional>  
#include <memory>  
#include <Eigen/Dense>  
Include dependency graph for ode.hpp: This graph shows which files directly or indirectly include this file:
```

Classes

- class [ODE](#)
Ordinal differencial equation solver.

5.17 src/ode/ode_impl.hpp File Reference

```
#include "ode.hpp"  
Include dependency graph for ode_impl.hpp: This graph shows which files directly or indirectly include this file:
```

Classes

- class [ODE_Euler](#)
Explicit Euler algorithm.
- class [ODE_Heun](#)
Second order explicit Heun algorithm.
- class [ODE_RK4](#)
Fourth order Runge Kutta algorithm.

5.18 src/ode/ode_test.cpp File Reference

```
#include "ode.hpp"
#include <gtest/gtest.h>
#include <numbers>
Include dependency graph for ode_test.cpp:
```

Classes

- class [ODETest](#)

Functions

- `std::vector< ODE::ODEMethod > getMethodsToTest ()`
- `TEST_F (ODETest, FromStringTest)`
- `TEST_F (ODETest, FactoryTest)`
- `TEST_P (ODETest, TestConstFunction)`
- `TEST_P (ODETest, TestFirstOrder)`
- `TEST_P (ODETest, TestRHSCalls)`
- `INSTANTIATE_TEST_SUITE_P (TestDerivedClasses, ODETest, testing::ValuesIn(getMethodsToTest()))`
- `int main (int argc, char **argv)`

5.18.1 Function Documentation

5.18.1.1 [getMethodsToTest\(\)](#)

```
std::vector<ODE::ODEMethod> getMethodsToTest ( )
```

5.18.1.2 [INSTANTIATE_TEST_SUITE_P\(\)](#)

```
INSTANTIATE_TEST_SUITE_P (
    TestDerivedClasses ,
    ODETest ,
    testing::ValuesIn(getMethodsToTest ()) )
```

5.18.1.3 main()

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

5.18.1.4 TEST_F() [1/2]

```
TEST_F (
    ODETest ,
    FactoryTest )
```

5.18.1.5 TEST_F() [2/2]

```
TEST_F (
    ODETest ,
    FromStringTest )
```

5.18.1.6 TEST_P() [1/3]

```
TEST_P (
    ODETest ,
    TestConstFunction )
```

5.18.1.7 TEST_P() [2/3]

```
TEST_P (
    ODETest ,
    TestFirstOrder )
```

5.18.1.8 TEST_P() [3/3]

```
TEST_P (
    ODETest ,
    TestRHSCalls )
```

5.19 src/parser/parser.cpp File Reference

```
#include "parser.hpp"
#include <Eigen/Dense>
#include <iostream>
#include <sstream>
Include dependency graph for parser.cpp:
```

Functions

- Eigen::MatrixXd [parseMatrixXd](#) (const std::string &input, int R, int C, char delimiter)
Parse input string to double matrix of specific shape and delimiter.
- Eigen::VectorXd [parseVectorXd](#) (std::string str, int noOfElem, char delimiter)
Parse input string to double vector of specific length and delimiter.

5.19.1 Function Documentation

5.19.1.1 parseMatrixXd()

```
Eigen::MatrixXd parseMatrixXd (
    const std::string & input,
    int R,
    int C,
    char delimiter = ' ' )
```

Parse input string to double matrix of specific shape and delimiter.

Parameters

<i>input</i>	input string
<i>R</i>	number of rows
<i>C</i>	number of columns
<i>delimiter</i>	delimiter

Returns

parsed matrix

5.19.1.2 parseVectorXd()

```
Eigen::VectorXd parseVectorXd (
    std::string str,
    int noOfElem,
    char delimiter = ' ' )
```

Parse input string to double vector of specific length and delimiter.

Parameters

<i>str</i>	input string
<i>noOfElem</i>	length of vector
<i>delimiter</i>	delimiter

Returns

parsed vector

5.20 src/parser/parser.hpp File Reference

```
#include <Eigen/Dense>
```

Include dependency graph for parser.hpp: This graph shows which files directly or indirectly include this file:

Functions

- Eigen::MatrixXd [parseMatrixXd](#) (const std::string &input, int R, int C, char delimiter=' ')
Parse input string to double matrix of specific shape and delimiter.
- Eigen::VectorXd [parseVectorXd](#) (std::string str, int noOfElem, char delimiter=' ')
Parse input string to double vector of specific length and delimiter.

5.20.1 Function Documentation

5.20.1.1 parseMatrixXd()

```
Eigen::MatrixXd parseMatrixXd (
    const std::string & input,
    int R,
    int C,
    char delimiter = ' ' )
```

Parse input string to double matrix of specific shape and delimiter.

Parameters

<i>input</i>	input string
<i>R</i>	number of rows
<i>C</i>	number of columns
<i>delimiter</i>	delimiter

Returns

parsed matrix

5.20.1.2 parseVectorXd()

```
Eigen::VectorXd parseVectorXd (
    std::string str,
    int noOfElem,
    char delimiter = ' ' )
```

Parse input string to double vector of specific length and delimiter.

Parameters

<i>str</i>	input string
<i>noOfElem</i>	length of vector
<i>delimiter</i>	delimiter

Returns

parsed vector

5.21 src/parser/uav_params.cpp File Reference

```
#include <Eigen/Dense>
#include "uav_params.hpp"
#include <iostream>
#include <fstream>
#include <filesystem>
#include <mutex>
#include "rapidxml/rapidxml.hpp"
#include "parser.hpp"
Include dependency graph for uav_params.cpp:
```

Functions

- void [parseHinge](#) (rapidxml::xml_node<> *hingeNode, [Hinge](#) *hinge)
- [PID](#) [parsePID](#) (rapidxml::xml_node<> *PIDNode)

5.21.1 Function Documentation

5.21.1.1 parseHinge()

```
void parseHinge (
    rapidxml::xml_node<> * hingeNode,
    Hinge * hinge )
```

5.21.1.2 parsePID()

```
PID parsePID (
    rapidxml::xml_node<> * PIDNode )
```

5.22 src/parser/uav_params.hpp File Reference

```
#include <Eigen/Dense>
#include <mutex>
#include <memory>
#include <map>
#include "rapidxml/rapidxml.hpp"
#include "../components/components.hpp"
#include "../PID/PID.hpp"
```

Include dependency graph for uav_params.hpp: This graph shows which files directly or indirectly include this file:

Classes

- struct [UAVparams](#)
Parsed UAV configuration from XML.

5.23 src/PID/PID.cpp File Reference

```
#include "PID.hpp"
#include <limits>
#include <algorithm>
```

Include dependency graph for PID.cpp:

5.24 src/PID/PID.hpp File Reference

```
#include <limits>
```

Include dependency graph for PID.hpp: This graph shows which files directly or indirectly include this file:

Classes

- class [PID](#)
PID discrete controller.

Enumerations

- enum [AntiWindUpMode](#) { [None](#) , [Clamping](#) }
Methods of handling windup in controller.

5.24.1 Enumeration Type Documentation

5.24.1.1 AntiWindUpMode

```
enum AntiWindUpMode
```

Methods of handling windup in controller.

Enumerator

None	
Clamping	

5.25 src/timed_loop/status.hpp File Reference

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

Enumerations

- enum `Status` { `idle` = 1 , `running` = 2 , `exiting` = 3 , `reload` = 4 }
- status of timed loop. Control it's job*

5.25.1 Enumeration Type Documentation

5.25.1.1 Status

enum `Status`

status of timed loop. Control it's job

Enumerator

<code>idle</code>	loop is ready to run
<code>running</code>	loop is running
<code>exiting</code>	loop will be break in next occasion.
<code>reload</code>	loop job should be reloaded

5.26 src/timed_loop/timed_loop.cpp File Reference

```
#include "timed_loop.hpp"
#include <stdint.h>
#include <chrono>
#include <thread>
#include "status.hpp"
#include <iostream>
```

Include dependency graph for timed_loop.cpp:

5.27 src/timed_loop/timed_loop.hpp File Reference

```
#include <stdint.h>
#include <functional>
#include "status.hpp"
```

Include dependency graph for timed_loop.hpp: This graph shows which files directly or indirectly include this file:

Classes

- class [TimedLoop](#)

Simulation of real-time synchronized loop.

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