Quad Rotor (Simple)

Software Functional Requirements Document

The MathWorks Application Engineering

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| **Module Type** | Quad Rotor (Simple) |
| **Function Name** | QuadRotorController |
| **Document Type** | Functional requirements |
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| **Approved by** | xxx |
| **Version** | v 0.2a : 2015/01/09 |
| **History** | v 0.1a : Initial version of this document |

1. **Interface Description**

This section describes all the inputs and outputs defined to be used for the Quad Rotor Control algorithm.

* 1. **Inputs**

This section describes input definitions used for the Quad Rotor Control algorithm.

* + 1. **Target Roll Angle [](http://localhost:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22QuadRotorController.slx%22,%22GIDa_6de544e6_7104_4681_8a5e_3983c09ec46f%22%5d)**

This signal is Roll control input for Quad Rotor Motion control.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Data type | Range | Unit |
| RollCtrlIn | double | -pi/2 ~ pi/2 | rad |

* + 1. **Target Pitch Angle [](http://localhost:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22QuadRotorController.slx%22,%22GIDa_439fcd65_8997_4b03_9b24_7821f1543fb1%22%5d)**

This signal is Pitch control input for Quad Rotor Motion control.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Data type | Range | Unit |
| PitchCtrlIn | double | -pi/2 ~ pi/2 | rad |

* + 1. **Target Vertical Position [](http://localhost:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22QuadRotorController.slx%22,%22GIDa_304abf88_b404_474a_871b_222db74cf1c2%22%5d)**

This signal is Vertical Position control input for Quad Rotor Motion control.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Data type | Range | Unit |
| VerticalCtrlIn | double | > 0 | m |

* 1. **Outputs**

This section describes output definitions generated by Quad Rotor Control algorithm.

* + 1. **Rotor 1 Control Output [](http://localhost:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22QuadRotorController.slx%22,%22GIDa_9cf257a6_e5fd_4c6e_b7b1_f99b1dcbeb26%22%5d)**

This signal is P1 Motor control for Propeller 1.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Data type | Range (Resol.) | Unit |
| V1 | double | 0 ~ 4 | Volts |

* + 1. **Rotor 2 Control Output [](http://localhost:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22QuadRotorController.slx%22,%22GIDa_d27c9447_f462_41af_93f2_098898be3d80%22%5d)**

This signal is P2 Motor control for Propeller 2.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Data type | Range (Resol.) | Unit |
| V2 | double | 0 ~ 4 | Volts |

* + 1. **Rotor 3 Control Output [](http://localhost:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22QuadRotorController.slx%22,%22GIDa_92a5a7b7_c6fe_4cb6_85b5_656c3a9c7d23%22%5d)**

This signal is P3 Motor control for Propeller 3.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Data type | Range (Resol.) | Unit |
| V3 | double | 0 ~ 4 | Volts |

* + 1. **Rotor 4 Control Output [](http://localhost:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22QuadRotorController.slx%22,%22GIDa_1ee7c42e_b07a_4c3c_a2e3_8aa0663f3f3e%22%5d)**

This signal is P4 Motor control for Propeller 4.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Data type | Range (Resol.) | Unit |
| V4 | double | 0 ~ 4 | Volts |

1. **Functional Requirements**
   1. **Function Description**

Quad Rotor Software is used in an embedded processor. It includes Quad Rotor motion control algorithm

* 1. **Quad Rotor Control Algorithm [](http://localhost:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22QuadRotorController.slx%22,%22GIDa_26445ae1_0f3d_43bf_bfb6_83657b312e80%22%5d)**

Quad Rotor Control algorithm controls motion of Quad Rotor vehicle. It obtains measured propeller and vehicle position data. It includes 3 subsystems such as Roll Control, Pitch Control and Vertical Position Control. Each subsystem computes 4 motor control command outputs. All outputs are finally combined to control 4 DC motor torques attached to propellers.

* + 1. **Roll Control [](http://localhost:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22QuadRotorController.slx%22,%22GIDa_b9c149d5_2032_46f0_9008_bb34186129cd%22%5d)**

Roll control algorithm obtains desired roll angle input and measured roll rate and roll angle data. It includes inner/outer loop PID controllers. Inner-loop controller controls roll rate and outer-loop controller controls roll angle. It computes 4 motor command outputs for roll motion control.

* + 1. **Pitch Control [](http://localhost:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22QuadRotorController.slx%22,%22GIDa_f433959a_2dda_4fbe_8330_40e2f4214206%22%5d)**

Pitch control algorithm obtains desired pitch angle input and measured roll rate and roll angle data. It includes inner/outer loop PID controllers. Inner-loop controller controls pitch rate and outer-loop controller controls pitch angle. It computes 4 motor command outputs for pitch motion control.

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* + 1. **Vertical Position Control [](http://localhost:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22QuadRotorController.slx%22,%22GIDa_d3a35302_3f5b_469f_95a3_461bb3fad183%22%5d)**

Vertical Position control algorithm obtains desired Z position input and measured vertical velocity and Z position data. It includes inner/outer loop PID controllers. Inner-loop controller controls vertical velocity and outer-loop controller controls Z position. It computes 4 motor command outputs for vertical position control.