AIDA Simulation MODELICA model
How to use the model

Abstract

This document presents the way to install and run the model with OpenModelica

Content

1 Open the model

Copy the AIDAModelica directory and the AIDA_System.mo model on your local workspace.

With OpenModelica (tested with OME Edit 1.11.0), import the AIDAModelica library using the OpenLibrary function and choose the AIDAModelica directory.

Then open the AIDA_System.mo model and double clic on it at the bottom of the file explorer.

2 Setup the Remote Control parameters

2.1 Manual mode

Default setting on AIDA_System.mo.

The drone starts on ground.

VerticalSpeedCommand : For takeoff, set the **VS_cmd_t[1]** to define the start time and **VS_cmd_t[2]** the end time. Set **VS_cmd** a negative value (Z axis oriented down) : e.g.-0.5 m/s

Ensure to have reach an altitude (**Position[3]** of the QuadcopterModel) above 1m to be able to flight without touching the ground
justification: the ground simulation is made with a simple spring simulation and the model is not ready for landing phase.

Then for each *direction* (Roll, Pitch and Yaw) , set :

- ***Direction*_cmd** a value in rad
- ***Direction*_cmd_t[]** two values in sec for start and end of the command, which is counted from **VS_cmd_t[2]**

Command smoothing :

On all manual command, a 1 order low filter with time constant **Tcst** is applied.

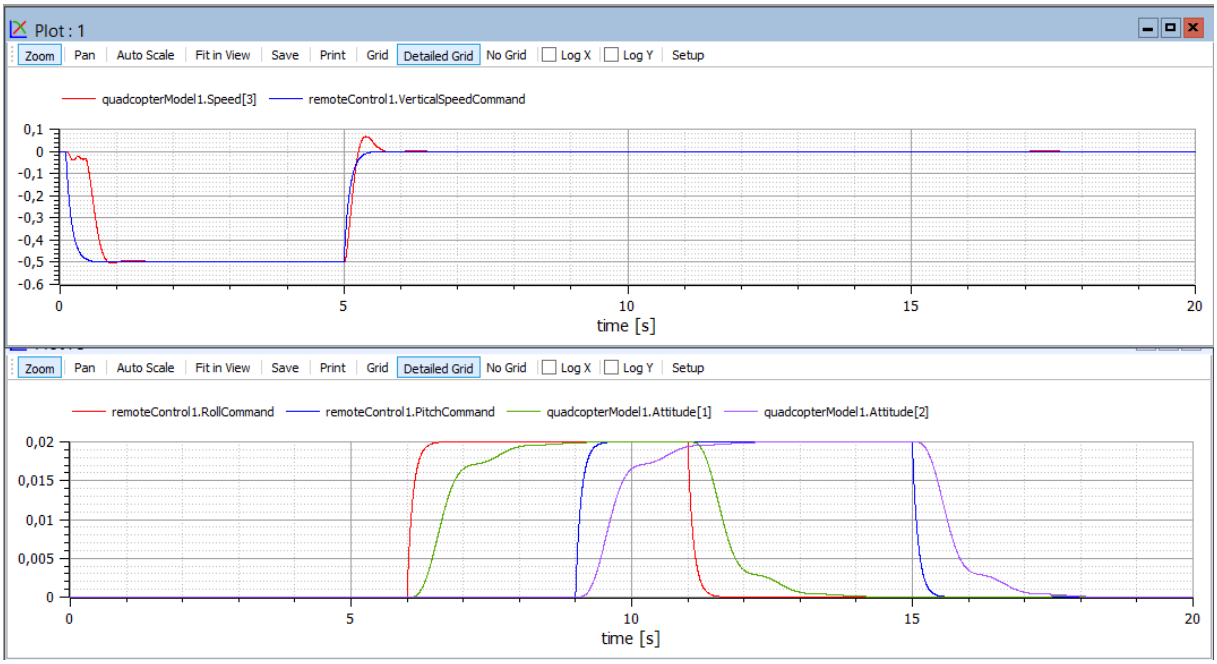

Figure 1: Vertical position and Pitch/Roll command and result in manual mode

2.2 Autopilot mode

The remote control parameter include the capacity to start the autopilot mode.

The auto pilot mode is started at**: Auto_Ctl_t** sec.

The flight plan includes the takeoff phase.

It is deactivated at the first manual mode input, which is : **VS_cmd_t[1]** sec, and cannot be reactivated. *Justification: reactivation of the autopilot need specific algorithm to decide where to start the flight plan back and has not been developed*

If **VS_cmd_t[1]** happens before **Auto_Ctl_t**, the autopilot is not activated.

The flight plan include the full inspection of the aircraft in 250sec.

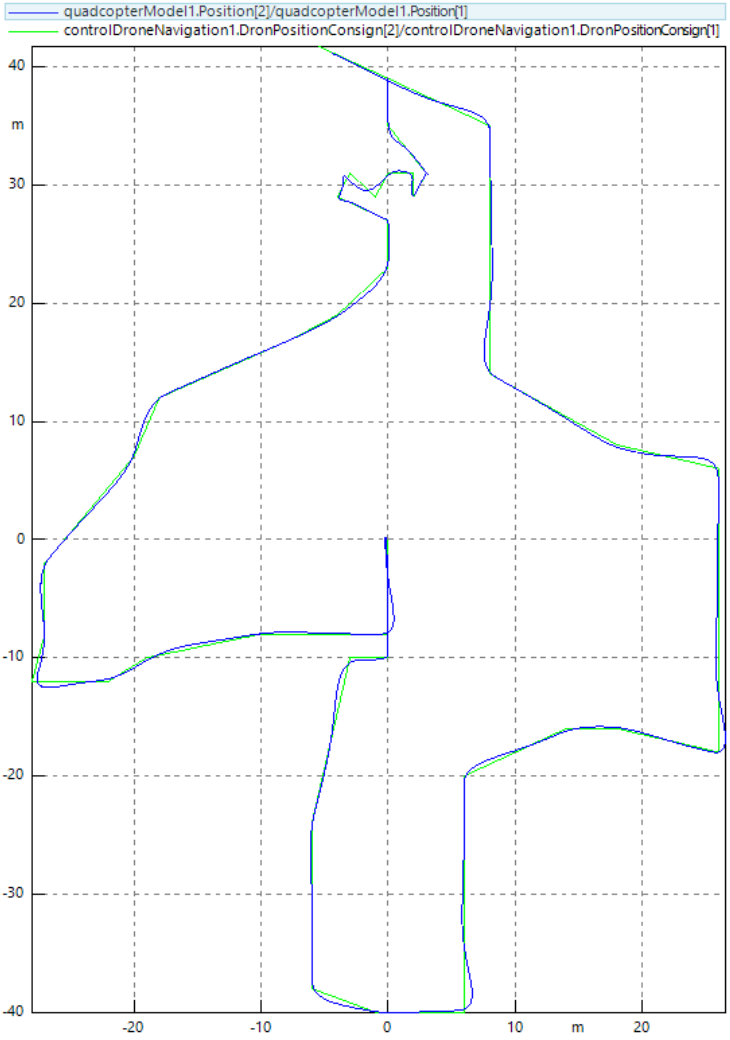

Figure 2: XY path of the drone following the flight plan

3 Initialization

By default, the model start motors off, on ground. To start at a position compatible with the flight plan, the Y position (Position[2]) integrator is initialized at 39m.

The Z position is initialized at -29cm which correspond to the drone feets 1cm compression, simulated as a single spring (see drone_feets model). The stability constrains at initialization compute the exact Z position corresponding to the drone mass.

4 Simulation setup

The following setup has been used for OpenModelica tests:

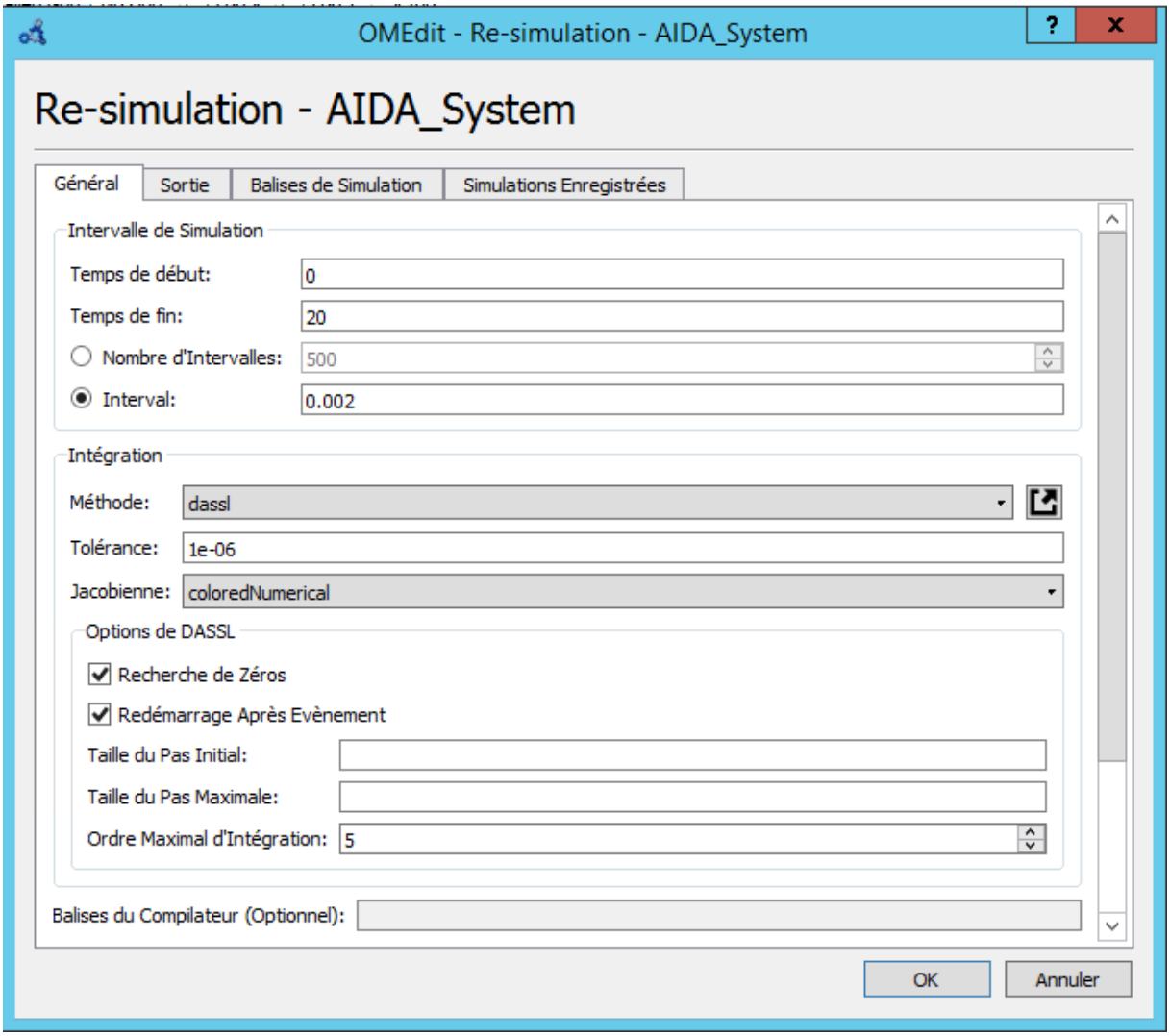

Figure 3: simulation setup

5 Adjust the PID parameters

For cosimulation purpose, the PID parameters have be adjusted to have a smooth control. For the same purpose, the Nd parameter of the Derivation block, which set the continuous derivation approximation dynamic has been reduced to lower the Derivation dynamic evaluation.

Warning : for co-simulation, the direct derivation (using the der() function) is not allowed by SimulationX

For information, the Attitude control has an effect on both Manual and Autopilot mode.

6 Open loop setting

In the LowLevelFlightControlSystem / AttitudeControl model, specific parameter can be activated to set openloop capacity and constant attitude command:

The **Test_open_loop[]** vector can force the angular speed feedback to zero on each axis respectively.

Test_CstMomentumActiv and **Test_CstMomentumValues[]** vector can override the momentum consign with constant momentums, on each axis:

```
MomentumsConsign[3] = if Test_CstMomentumActiv then Test_CstMomentumValues[3]
else controlYawAngle1.MomentumZ;
  MomentumsConsign[2]       =       if       Test_CstMomentumActiv       then
Test_CstMomentumValues[2] else controlPitchAngle1.MomentumY;
  MomentumsConsign[1]       =       if       Test_CstMomentumActiv       then
Test_CstMomentumValues[1] else controlRollAngle1.MomentumX;
```

7 Wind force

On Quadcoptermodel, the **Fx** and **Fy** parameter can set a constant force on X and Y direction