

# **Project Based Learning:**

## **AIRCRAFT DYNAMICS - MODELING – SIMULATION**

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### **Project Overview:**

The dynamic model is developed using the RCAM model (FM\_AG-08\_TP088-9).

### **Standards:**

- MATLAB R2016b
- Simulink
- FlightGear v2016.1

### **Objectives:**

- Apply the knowledge of the flight mechanics
- Use Simulink to implement the equation of motion and aerodynamics
- Simulate the results using an interface such as Flight gear or X-plane.

### **Requirements/Task(s):**

First establish the 6 DOF dynamic equations for the aircraft as a state space differential equation;

Secondly establish the aerodynamic forces and moments in the appropriate frame;

And finally solve for the state.

### **Record your notes/research here:**

The data concerning the aircraft properties such as its inertia, aerodynamic coefficients with respect to the angle of attack and side slip angle, the input restrictions from the control surfaces and the mass are obtained from the RCAM model (aircraft).

### **Outline the steps/plan for your project:**

- ❖ Establish the state vector and control vector;
- ❖ The control limits/saturation;
- ❖ The intermediate variables with respect to the state variables;
- ❖ The aerodynamic force coefficients (normalized);
- ❖ The dimensional aerodynamic forces;
- ❖ The aerodynamic moment coefficient about the aerodynamic center in body frame (normalized);
- ❖ The aerodynamic moment about the aerodynamic center in body frame;
- ❖ The aerodynamic moment about the center of mass(cg) in body frame;

- ❖ The engine force and moment ;
- ❖ The gravity force in body frame;
- ❖ The state derivative: Inertia matrix, total force and moment acting at the cg, the first order form of the aircraft motion.

### **Summarize what you learned:**

- ❖ Deeper understanding of the aircraft motion (flight mechanics)
- ❖ Aircraft static and dynamic stability;
- ❖ Practical simulation of the aircraft motion in MATLAB/Simulink and flight simulator interface;

### **Add the link to your project here:**

[https://github.com/Alex-Zongo/Aircraft\\_Dynamics\\_Modeling\\_Simulation](https://github.com/Alex-Zongo/Aircraft_Dynamics_Modeling_Simulation)