

Performance Analysis and Improvement of the NASA HL-20 Lifting Body Flight using Model Based Systems Engineering Methodology

Code: 21/48

Company: UWE Bristol

Location: Bristol or online

Company Description:

The University of the West of England is a public research university based in Bristol. The University is focused on solving future global challenges through outstanding learning, world-leading research and a culture of enterprise. The faculty of Engineering is based on the Frenchay Campus and works closely together with regional aerospace partners. The Bristol Robotics Laboratory (BRL) is the main research centre for the Faculty with over 300 academics, researchers and industrialists. It has 18 research themes include self-repairing robotics systems, smart automation, robot vision, bioenergy and self-sustainable robots and aerial robots.

Project Description:

The model-based system engineering (MBSE) is currently the industry favoured design methodology that integrates lifecycle phases via a digital thread ultimately achieving a digital twin of the space vehicle. The performance analysis of the NASA HL-20 lifting body Simulink model, utilising the new and innovative MBSE paradigm would focus on defining the operational dynamics of the HL-20. The work involves implementing improvements to the flight modes and over multiple domains to display the HL-20's behaviour characteristics under different operational ranges of the flight controllers.

The vehicle's actuators interface to the external surfaces that require fine control in different flight phases such as landing and take-off. The role requires improving the control and stability of the HL-20 Lifting Body in the longitudinal and lateral axes i.e., roll, pitch and yaw by tuning the rate ramping of the control surfaces. The objective is to linearise the HL-20 Simulink model and utilise different methods within control theory to determine the optimal feedback signal gain values for the stability and control of the system and to assess and compare the best control solution for the HL-20 control surfaces. Aerodynamic effects and wind conditions will be considered for tuning the controllers.

The intern will set logical and temporal assessments on performance characteristics for verification and validation activities (V&V) and link the V&V process to model requirements using the MBSE techniques and Simulink tools. Another objective is utilising the Digital Thread/Digital Twin software environment for achieving a co-simulation by coupling the

system architecture model written in System Modelling Language (SysML) for Cameo with control Physics workspace in Matlab and Simulink.

Applicant Specification:

A self-motivated and quick learner candidate is needed typically finishing a BEng aerospace degree with a background in space systems and having essential modules and coursework required in the project description. The applicant should possess an overall good understanding of feedback control theory. A derive to be at ease with complex simulation software tools is an absolute must.

Minimum Requirements:

Knowledge of space/aerospace vehicle flight dynamics
A solid foundation in control and stability theories and capabilities of different controllers
Fundamental knowledge of model-based systems engineering methodology (MBSE)
Proficiency in Matlab and Simulink (Aerospace Blockset, Aerospace toolbox, Simulink Requirements and Simulink Test toolboxes)

Preferred Additional Requirements:

- SysML programming and tools (Cameo, Modelio or similar)
- Experience in setting up co-simulations
- Knowledge of flight control surfaces and aerodynamics

Further details:

8 weeks minimum fixed term contract to be agreed with the successful candidate. Virtual Induction Event to be held on 21 June 2021. Ideally to complete before the start of the next academic year. Salary is £1,500 per calendar month gross.

Closing Date for Applications: 5pm Wednesday 9 June 2021

Applications should be made through the online form on the Satellite Applications Catapult website before the closing date.

<https://sa.catapult.org.uk/work-with-us/space-placements-industry-spin/>

Please note that elements of the form left incomplete will be deemed to render the application ineligible. They will be checked for eligibility and forwarded to the employer. Email applications made to the Satellite Applications Catapult, UK Space Agency, or host organisations will not be processed.