

**SE<sup>2</sup>A International Female Programme: International Master's projects  
Assessment of Metamaterials in Wing Carrying Structures for Load Alleviation**

### **Project Description**

An aircraft is designed to withstand a variety of load scenarios, including gust loads that exceed several g-loads. These loads influence the design and thickness of the carrying structure of the wing box, with the wing root being the most critical point. By reshaping the wing load distribution, it is possible to reduce the bending moment at the wing root, which can subsequently decrease the thickness of the carrying structure and, therefore, the overall mass of the wing. To effectively reshape the aerodynamic forces, the structure must adapt its flight shape and achieve favorable deformations. The goal is to reduce the angle of attack at the outer wing section, which results from bending and torsion under load. The SE<sup>2</sup>A Cluster project, HyCoNoS, investigates nonconventional passive load alleviation concepts, particularly the use of large deformations for shape adaptation. However, shape adaptation is limited by the properties of the materials used. At this stage, we are transitioning away from traditional materials and focusing on metamaterials to achieve the desired behavior.

Within this context, you will identify the optimal metamaterial matrix that can be introduced in a wing-box segment to enhance bending/torsion coupling and reduce aerodynamic loads in the outer wing. To achieve this, you will propose suitable cell designs, characterize them, and evaluate the mechanical behavior of the matrix when subjected to combined stresses.

### **Requirements**

- **Solid background in mechanics of materials and the finite element method**
- **Experience with any FE solver is a plus but not a must**
- **Basic knowledge of Python**
- **High degree of structured, independent work**
- **Proficiency in written and spoken English**

### **Contact information**

M. Sc. Jorge Bustamante

Technische Universität Braunschweig

Institut für Flugzeugbau und Leichtbau (IFL)

Hermann-Blenk-Str. 35, 38108 Braunschweig, Germany

jorge.bustamante@tu-braunschweig.de, Phone: +49 531 391 9911

Candidates with handicaps will be preferred if equally qualified. Please enclose a proof. The position is part of the SE<sup>2</sup>A International Female Programme, so only applications by female students of non-German universities are possible. Applications from people of all nationalities are welcome. **Please note that application costs cannot be refunded.**

The personal data will be stored for the purpose of processing the application. By submitting your application, you agree that your data may be stored and processed electronically for application purposes in compliance with the provisions of data protection law. Further information on data protection can be found in our data protection regulations at <https://www.tu-braunschweig.de/datenschutzerklaerung-bewerbungen>.