Technische Universität Braunschweig

MUSEN

An Aircraft from Nothing
Towards the Design of Future Aircraft using Multidisciplinary Topology Optimization

Lecture of

Prof. Dr.-Ing. Ali Elham

Institute of Aircraft Design and Lightweight Structures
TU Braunschweig

8. Juli 2021, 17.00 Uhr

Webex Meeting:

http://bit.ly/musen-kolloquium-elham
Meeting number: 121 332 1284
Passwort: 3c8gNAWfUh3

To preserve our environment, we are facing severe challenges in reducing the emission of air transportation. Based on the targets of 2050, we need to reduce the CO2 emission of aviation by 75%, NOx by 90%, and noise by 65%. Considering the current development in civil aircraft, the rate of improvement will not result in the expected reduction in emission by 2050. To resolve this problem, new technologies, such as eclectic/hybrid-electric aircraft, are suggested. However, there is still an open question: how the future aircraft should look like? Still a tube and wing? Something slightly different, like a forward-swept wing? Or something totally different, like a blended wing body?

So far in the aircraft design process, the choice of configuration has been a pure human-driven task. Based on their knowledge and experience, designers used to suggest some configurations, but each has its pros and cons. Which one is the best? No one knows! And even if we can compare all of them and find the best one, it still does not mean that there is no other configuration, which gives more improvement in reducing aircraft environmental impact.

To resolve this problem, once and for all, we are working to develop a digital design environment capable of finding the best aircraft configuration. Mathematically the aircraft configuration is defined as the aircraft topology. Therefore, to find the optimum configuration, topology optimization is required. However, since the aircraft design is a multidisciplinary task involving various tightly coupled disciplines, such as aerodynamics, structure, performance, and propulsion, a multidisciplinary topology optimization methodology, as well as tool, is required.

In this talk, I will discuss my current work and plan towards developing a digital design framework based on multidisciplinary topology optimization, which can search for the optimum aircraft configuration for a given set of technologies to minimize the environmental impact of future transport aircraft.