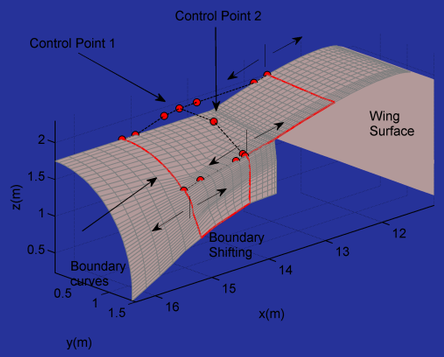
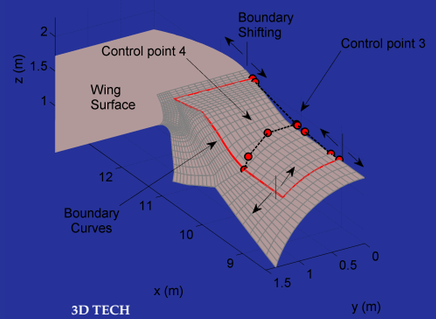
The Development of Methodologies for the Aerodynamic Design and Optimization of New Regional Turboprop Aircraft is presented proposing innovative procedures and tools to improve the aerodynamic of this aircraft category. Nowadays the increase in oil price, the huge growth of air transport traffic and the increasing attention to the aircraft environmental footprint led to considerable interest of specialists in new configurations of regional transport aircraft. Airlines and aircraft industries forecast in the next twenty years about 12000 turboprop aircraft will be delivered. Of these aircraft about 7000 will replace the older turboprop which reach their product life-cycle, while the remaining amount of about 6000 aircraft will be new turboprop aircrafts to satisfy market needs. The 61% of new turboprop delivered expected to be under 70 seats category (20% under 50 seats and 41% of 70 seats), while the new 90+ seat segment is a strong percentage of the total, i.e. the 39%. This work aims to provide some guidelines in the aerodynamic design and optimization of future regional turboprop aircraft with about 90 or more passengers. Particular emphasis is posed on aircraft performance, to highlight how a more accurate aerodynamic design can improve aircraft performance and so give aerodynamic guidelines in the design of new turboprop aircraft configurations. Research work can be divided into three main topics: airfoil design and optimization, aircraft components design and optimization and vertical tail design. Airfoil design and optimization have been analyzed and put together into a user friendly code which allows to design and optimize a generic airfoil geometry choosing the parameterization technique, the optimization algorithm and the aerodynamic solver. Concerning the aircraft components design, by coupling non uniform rational b-spline (NURBS) and a panel code aerodynamic solver, the geometry of a regional turboprop nose, wing-fuselage junction and undercarriage vane have been optimized to reduce aircraft aerodynamic drag. For the last topic a Navier-Stokes aerodynamic solver has been used, leading to a new method named VeDSC (Vertical tail Design Stability and Control) to design a vertical tail and a rudder.





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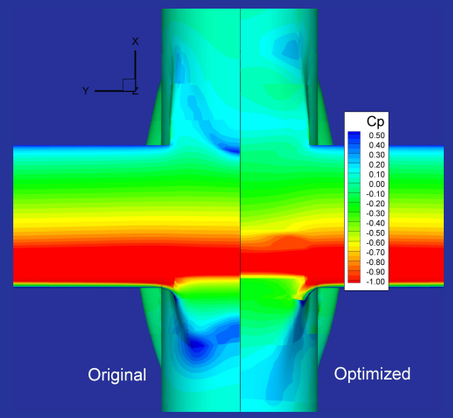

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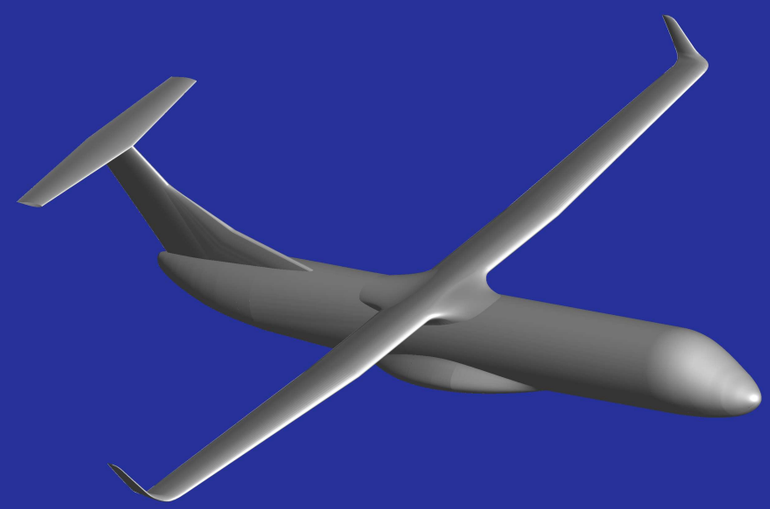

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