WIND TUNNEL BIDIMENSIONAL PARAMETRIC INVESTIGATION ABOUT BIPLANE CONFIGURATIONS

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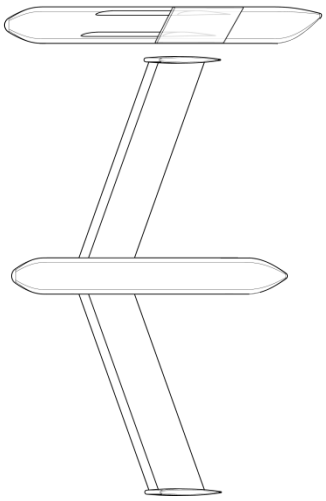
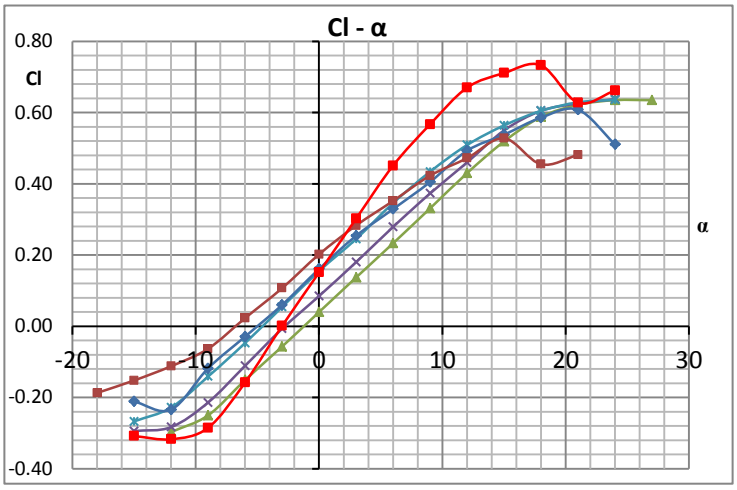
ABSTRACT

This paper presents an experimental and systematic investigation about the influence of geometric parameters on biplanes configuration (such as stagger, decalage, and gap between upper and lower wing) in aerodynamics parameters. This experimental investigation was developed in a bidimensional approach. Among the unorthodox configurations [1,3,4,5] proposed in new airplane designs, identified in terms of the number and position of lifting-surfaces, the box-wing configuration is a lay-out in which the lifting surfaces (wing and horizontal tailplane) are connected. Theoretical studies about biplanes configurations have been developed in the past [5, 9], but there isn´t enough information about experimental wind tunnel data, in the range of low Reynolds number.

This paper presents an experimental bidimensional study, as a first step to further tridimensional investigations about feasibility of several solutions. We present a series of experimental data, obtained in a wind tunnel for low Reynolds number values. The box-wing configuration has been employed in a small number of existing UAV, and this is a promising field of actuation applied to new aerodynamics studies and design of unmanned aerial vehicles, and to which the authors have devoted their research efforts for quite a long time now [6, 7 ,8, 10]. The data will be presented into several graphs, such as: $Cl - \alpha$, $Cd - Cl$, $\frac{Cl}{Cd} - Cl$, $Cm - \alpha$, $\frac{\sqrt{Cl}}{Cd} - Cl$, $\frac{Cl^{\frac{3}{2}}}{Cd} - Cl$. On the basis of this experimental information, a set of conclusions about the best configurations are proposed. These selected lay-outs will be based on mission criteria (maximum endurance, maximum range, short take-off and landing). Finally, we show the configuration which best accomplishes the aerodynamics criteria.





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