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| Abstract | <p>The Box-Wing is a non-planar aircraft configuration that is composed of two wings joined by winglets. In the scope of this paper aerodynamic efficiency of this configuration is investigated. The focus thereby does not lie on the induced drag alone; also viscous as well as wave drag is taken into account. Influences of the wing design parameters on the aircraft's aerodynamic efficiency are investigated. Aerodynamic calculations are conducted with an in-house tool. It includes a multiple lifting-line method combined with an extended flat-plate solution for turbulent flow. A semi-empirical methodology is applied to determine transonic effects. The tool is applicable to arbitrary aircraft configurations. In order to identify the main design parameters and the influences on the aerodynamic efficiency, a parameter study is conducted. For inviscid drag calculations the aerodynamic efficiency increases with enlarged vertical offset of both wings. The aerodynamic optimum, however, is shifted towards smaller gaps for viscous flow. Furthermore, an optimum was determined for two Box-Wing configurations with two different applications – short-range and long-range aircraft. These optimized designs are then compared against two aircraft in conventional configuration.</p> |