Comparison of Experimental Results and FEM Simulations for a High-Altitude Aircraft with a Joined-Wing Configuration

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Keywords: joined-wing, composite structures, static testing, FEM validation, aeroelasticity

Abstract. The present work focuses on validating numerical simulations against experimental data from a static test of an ultralight unmanned aircraft with an unconventional composite wing. The model under investigation is based on the F1A remote-controlled aircraft and includes two different geometric configurations of the joined-wing: a classic layout, in which the front main wing is located below the rear wing, and an inverted layout.
The numerical models were implemented in ANSYS Mechanical and MSC Nastran and account for the composite structure's material properties. Since these models are intended for use in aeroelastic investigations, they need to be checked first.
The validation of the computational approach is based on a series of static tests conducted on a prototype. The experimental campaign includes measurements of vertical deflections and torsional deformations under controlled loading conditions. The collected data allow for a direct and reliable comparison with the numerical predictions.
The results obtained show good agreement between the experiments and the FEM simulations for both connected wing configurations and thus support the use of the present numerical approach in further aeroelastic investigations as well as in the structural design of unconventional high-altitude aircraft.