AIRFOIL TESTING IN TRANSONIC S-1 WIND TUNNEL WITH SLOTTED WALLS TEST SECTION

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The purpose of the project is the assessment of the aerodynamic characteristics of some new helicopter rotor blade profiles (C_L, C_D and C_M) at different Mach number (from subsonic up to transonic Mach number) and at different angle of attack (about 10 to 15 different angle of attack for each test, going from – 15° to 14°). Some tests will also have to be realized in turbulent flow.

The finite dimensions of a wind tunnel test section considerably influence the flow pattern around a tested airfoil. This is known as wall interferences. A solution to reduce the interferences effects on a profile is to allow a part of the flow to escape from the test section. This is made possible in the VKI S-1 transonic test section which is equipped with slotted walls. The remaining interferences can be assessed and corrected by using a wall signature method involving a Cauchy integral approach. This Cauchy integral method allows the assessment of the wall interferences by measuring the pressure distribution over the profile and the pressure distribution on the test section top and bottom walls only.

In order to determine the aerodynamic characteristics of the new profiles, the validity of the wall interferences assessment and correction method has to be confirmed and the influence of different test parameters on the results, like the Mach number, the tunnel total pressure or the angle of incidence, must be studied. A DLR R4C profile will be used to reproduce some old tests and a comparison with the previous results will be made.

Another objective of this report is the implementation of a drag determination method which is based on pressure measurements in the profile wake only.

The different test results will be given as a representation of the pressure distribution on the tested airfoil and on the tunnel top and bottom walls.

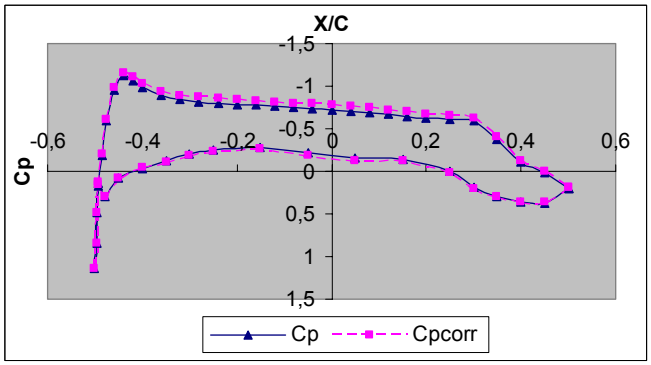

Figure 1: Influence of the wall interferences correction on the pressure distribution over a profile

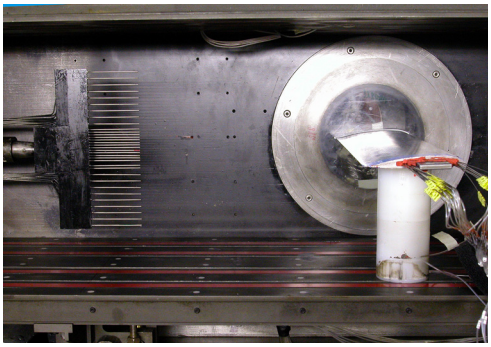

Figure 2: Drag assessment by integration of pressures in the airfoil wake