EFFECT OF ROUGHNESS INDUCED TRANSITION IN A VERY HIGH LIFT LOW PRESSURE TURBINE CASCADE

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In high loaded LP turbines, operating at very low Reynolds number conditions, the laminar boundary layer is not able to overcome the adverse pressure gradient in the rear part of the suction side of the blade and tends to separate. Introducing a roughness element on the suction side of the blade, it is possible to induce the transition, avoiding separation.

The aim of the project is to put in evidence the effect of the roughness induced transition by comparison of the aerodynamical performance of two profiles (with and without the roughness element). The investigation has been carried out over a Reynolds number range extending from 50000 to 190000.

At midspan the rough profile gives better performance in terms of losses and exit flow angle in the lower part of the Reynolds number range. The analysis of the boundary layer integral parameter and intermittency factor evolution, gives the opportunity to well explain the transition process and its effect on the aero-dynamical performance of the rough blade.

In the secondary flows region the high level of disturbances, related to the presence of the secondary flows, naturally triggers the transition. So the roughness represents only an obstacle for the flow. For all Reynolds numbers, this results in a higher level of losses.

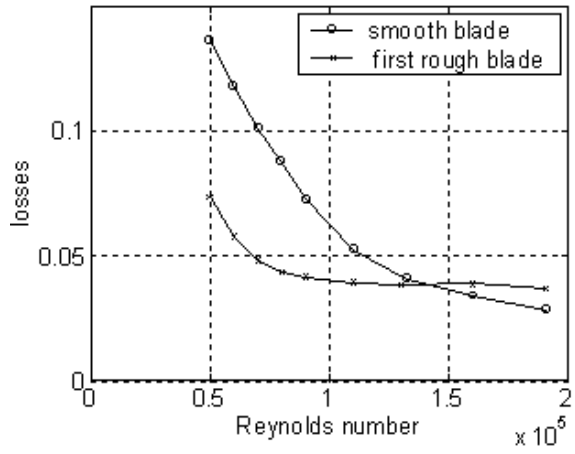

Figure 1: Losses VS Reynolds at midspan

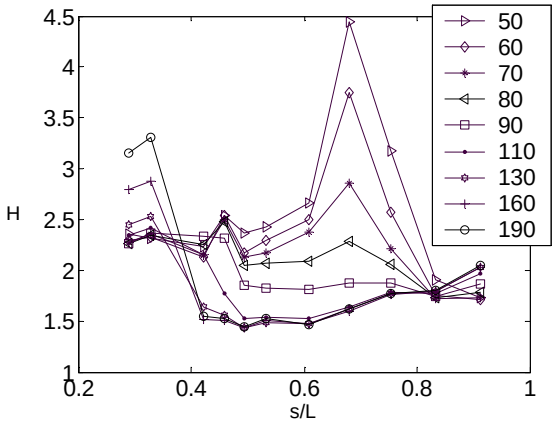

Figure 2: Shape factor evolution along the rough blade