Comparison of far wakes behind a solid disk and a three-blade rotor

A comparison of the wakes developed behind an immobile bluff body (solid disk) and a three-blade rotor at different rotational speeds is studied to find a correlation between them. LDA and PIV were applied to study the wakes behind both models in a water flume (Re ≈ 2.3·10^5). Everywhere in both wakes, a constant value of the Strouhal number was found to be equal to 0.23 for a three-blade rotor and 0.15 for a solid disk. This Strouhal number is in good agreement with the constants that usually characterize the wake oscillations behind immobile bluff bodies. The comparison of axial velocity deficit and rms of the velocity in both far wakes for the disk or the rotor shows a rational decay with the same power –2/3. It has good agreement with the analytical formula for the decay of the velocity deficit behind bluff bodies. A limit for using this model restricted by the turbulence level of the initial free flow was found experimentally.

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