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SOME NEW RESULTS ON THE INFLUENCE OF TURBULENCE SCALE ON BY-PASS TRANSITION IN A BOUNDARY LAYER

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It is well known that the external turbulence causes an earlier laminar-turbulent transition of the flow in a boundary layer which consequently leads to an increase of skin friction. It is possible to characterize the turbulence by its two main features: intensity and scale, usually related to a velocity along an average stream line. The influence of turbulence intensity on transition is quite well learned, but there are still very few investigations relating to the influence of the turbulence scale on laminar-turbulent transition. The transition appears earlier when the mesh of the grid is greater (Mayle, 1991), what implies a greater length scale.

Other experimental results (Jonas et al., 2000) indicate the laminar – turbulent inception moves downstream with the decreasing of turbulence scale; the length of transition also becomes shorter. For larger values of dissipative length scale, *Lu*, the laminar – turbulent transition process ends earlier. Unfortunately, there are not made non-dimensional values for turbulence scale in the literature. Besides, the authors of the two papers claim themselves that the use of their correlations are rather limited. In the other author's opinion (Epik, 2001), it seems to be quite opposite; the reducing of turbulence scale should provide an earlier inception, i. e. the lower Reynolds number, Re_t^{**}. That is why, the previous investigations require some revision.

The results of present investigations seem to confirm the results of Jonas, but only if we make correlation for all grids together (Fig. 1). But when we look at every grid separately, the result seems to be quite opposite. The momentum thickness Reynolds number, Re_t^{**}, for every grid apart increases as *Lu* increases. Besides, the higher are the values of *d* (diameter of the grid wire) and *M* (the mesh size), the higher is the value of the coefficient *k*. The mesh sizes were from 1 to 10 *mm*, and wire diameters from 0.3 to 3 *mm*. Greater value of the grid in figure 1 means greater grid dimensions *M* and *d*.

The turbulence scale is made non-dimensional by the use of grid wire diameter *d*. Figure 2 shows the results of Re_t^{**} as a function of *Lu/d*.

To describe the intermittency factor γ, the three parameters cumulative Weibull distribution function was used. To determine the transition region the local shear stress C_f was measured along the flat plate.

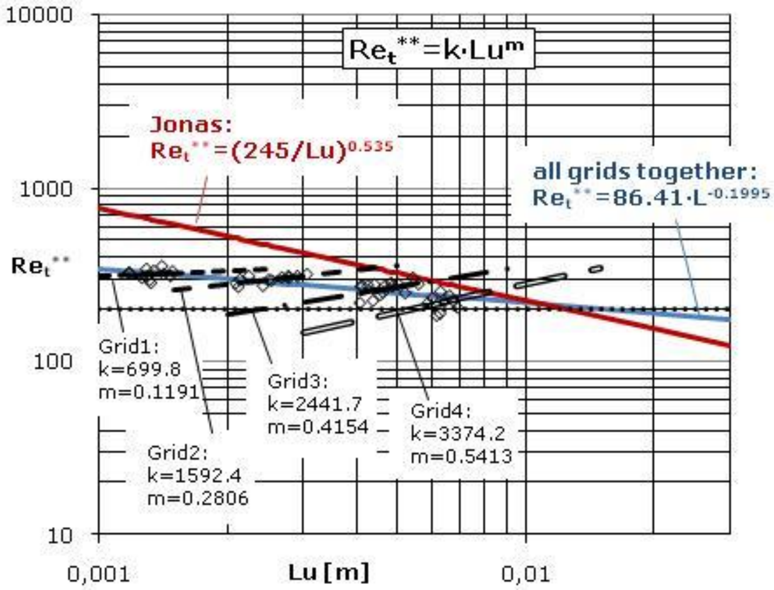

Fig. 1. Momentum thickness Reynolds number at the onset of transition as a function of turbulence scale

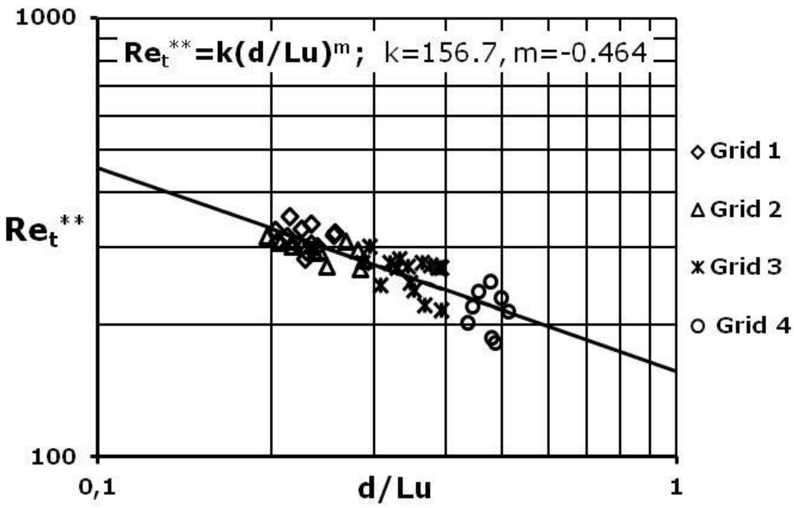

Fig. 2. Momentum thickness Reynolds number at the onset of transition as a function of *d/Lu*; correlation coefficient *r*=-0.86

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