Scale-by-scale energy budget behind the crossbar in near-flied

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Velocity measurements are carried out in the near-field wake of a crossbar (made by two orthogonal square cylinders of diameter D) with the aim to determine how the large scale structures, which are characteristics of this flow range, affect the energy variance. The assessment is performed through the transport equation for the second order (longitudinal) velocity structure functions, $\delta u(\equiv u(x+\delta x)-u(x))$, given by:

$$-\left\langle(\delta u)^3\right\rangle + 6\nu\frac{\partial\left\langle(\delta u)^2\right\rangle}{\partial r} + I_u = \frac{4}{5}\left\langle\epsilon\right\rangle r \tag{1}$$

This equation can be interpreted as a scale by scale energy budget, where I_u represents the contribution from the large scale motion.

All terms of equation (1), normalized by the dissipation term (right hand), are displayed in figure 1 for different x/D. Term I_u is inferred from the equation using the other terms directly measured. Data of grid turbulence[1] are also shown. The budget is dominated by the viscous term at small scales and by I_u at large scales. The third order moment reaches a maximum value at $r/\lambda \sim 1.5$. The budget behind the crossbar seems to differ from that of grid turbulence (Lavoie[2] and Burattini & al[2]).The difference is currently investigated and further results at higher R_λ will be presented and discussed at the conference. Our attention will be focused on the scale by scale budget at the centerline and away from the centerline with the aim to determine how the I_u term evolves.

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[1]Lavoie, *Phd Thesis.* **(2006)**

[2]Burattini P, Antonia R A & Danaila L, *Phys. Fluids.* **6, (2005)**

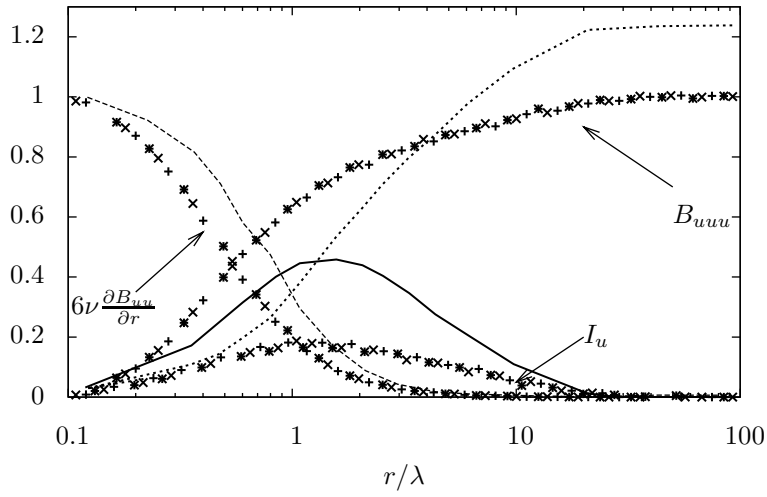


Figure 1: Term in (1) measured on the centerline at $X/D = 40$ (+) $X/D = 60$ (×) and $X/D = 80$ (∗) for a $R_\lambda \sim 26$. Lines are Lavoie's data of in a grid turbulence ($R_\lambda \sim 49$).