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Measurement of Vortex Structure at the Rotor Exit of Turbo-fan

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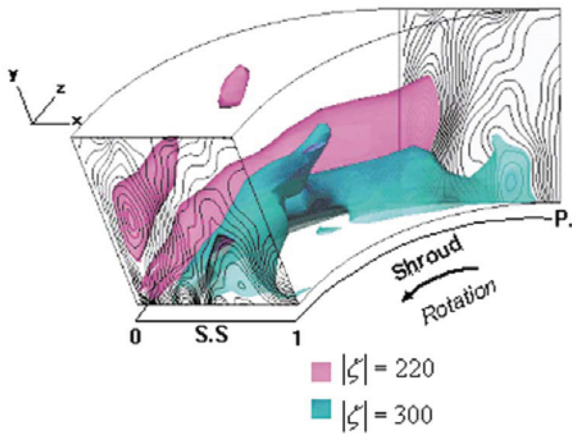


Fig.1. Shear layer vortices

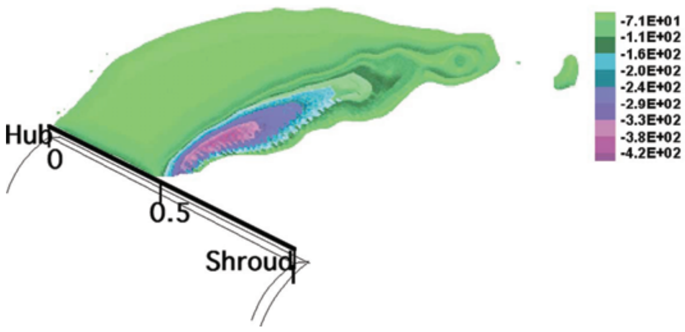
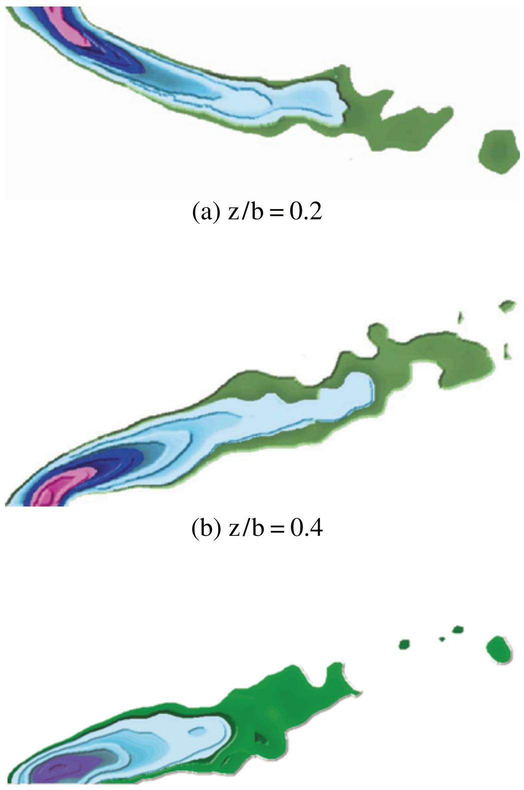


Fig.2. Tip vortices across the span wise



(a) z/b = 0.2

(b) z/b = 0.4

(c) z/b = 0.8

Fig.3. Tip vortices

The tip vortices and shear layer vortices were studied experimentally by using the high resolution PIV technique. The tested turbo-fan having 11 backward-curved blades with a blade outlet angle of 45 degree was rotated at the speed of 900 rpm. The shear layer vortices (Fig. 1) were achieved by averaging 500 stereoscopic PIV measurement data made at 22 circumferential planes, which ranged from 0 degree (blade suction surface) to 32 degree (blade pressure surface). Phase average tip vortices (Fig. 2) were calculated by the 300 instantaneous PIV measurement results at every 20 planes across the span wise. The difference in the magnitude of the velocity speed at these points guarantees that the tip vortex, which is an important factor of noise, is generated around these points. At the location of (z/b = 0.4) where a distinctive difference exists in the magnitude of the velocity speed, a large scale of vortex is formed as can be seen in Fig. 3.