Journal of Zhejiang University-SCIENCE A (Applied Physics & Engineering)

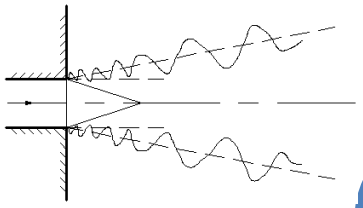
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Characterization of the mean velocity of a circular jet in a bounded basin

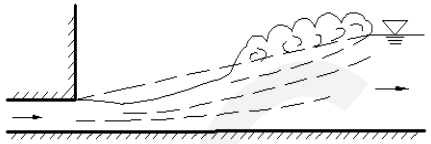
Jun-ning LI

Key words: Circular jet, Velocity decay, *Fr* , Offset height , Submergence ratio

Reasearch backround



Free jet



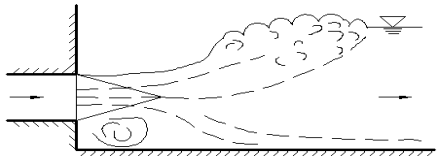
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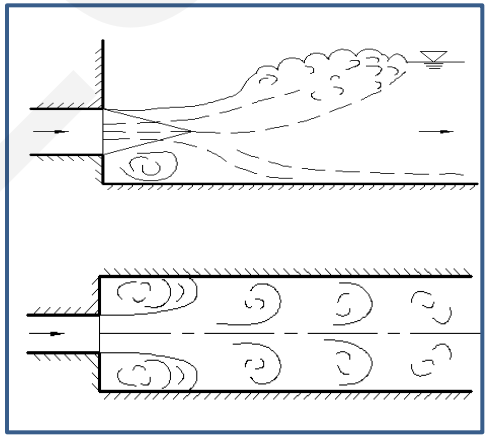
Jet

Wall jet

Offset jet

Bounded jet



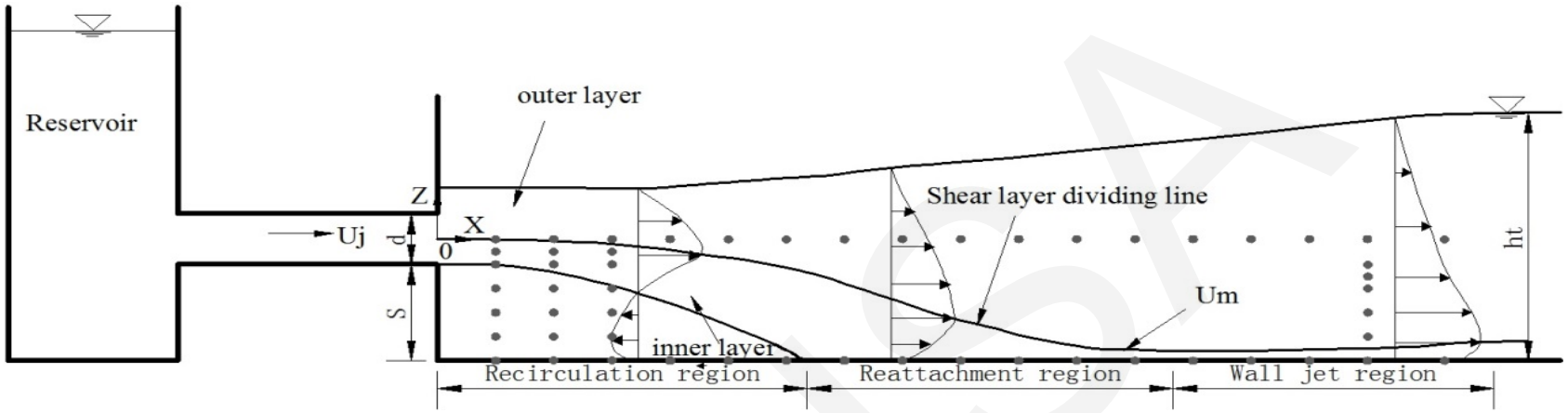


Applied to

- Aerospace Engineering
- Urban drainage
- hydraulic engineering
- Petrochemical Engineering
- irrigation engineering

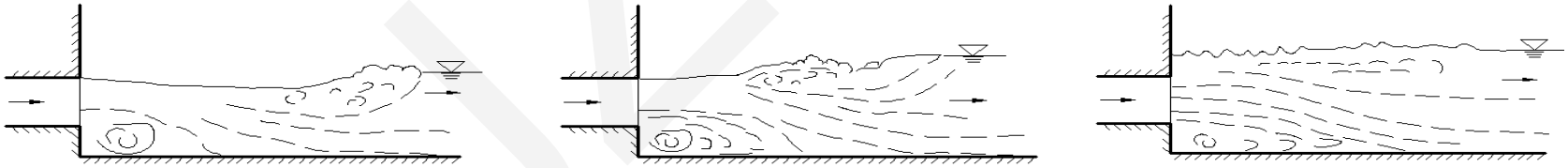
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Experimental configuration



Sketch of the experimental circular jet with offset (side view)

Flow pattern:



Surface jet **Mixed jet** **Submerged jet**

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Experiment configuration

Experiment tests

Offset height： ***S/d*=1, 2, 3,**

***Fr*：** ***Fr*=2.57, 3.46, 4.06, 5.30;**

Flow pattern： **Surface jet、Mixed jet and Submerged jet.**

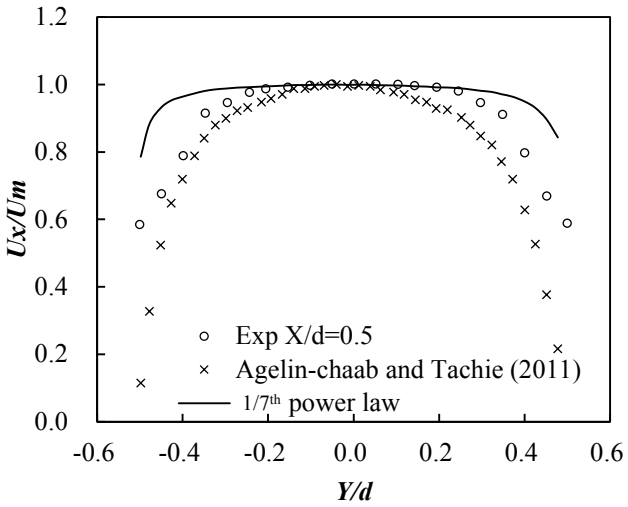
Velocity instrument： **LGY-II propeller flow meter** (Nanjing Hydraulic Research Institute)

Measurement accuracy： **1cm/s;**

Measurement time： **5s;**

Measurement velocity range： **0~7m/s.**

Verification： **pipe flow1/7th law.**



Conclusions

1. A velocity decay formula for a circular jet was proposed, and the lateral velocity spread was more consistent with a Gaussian and Cauchy–Lorentz distributions than the vertical velocity.

2. *Fr* had little effect on the decay of the mean velocity for a circular jet when $Re > 1 \times 10^4$.

3. The lateral and vertical spreads showed a quadratic relationship with the streamwise distance for different values of Fr at $X/d < 10$.

4. The positions of maximum mean velocity decay were independent of Fr and S/d when $X/d < 10$.

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Perspective

The decay, spread and maximum velocity position of the mean velocity for a circular offset jet can remain stable under different values of Fr, offset height and submergence ratio.



The research results have been successfully applied to the pressure discharge tunnel of Xiangjiaba Hydropower station.