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Short Communication

Some Unexpected Results of Experimental Measurement of Papers in Experiments in Fluids

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Text

In this letter, the papers by Lin & Sheu [1] and Wang et al. [2] were published by Experiments in Fluids have been carefully examined. A physically unreasonable phenomenon is that, based on the exact same experimental setups, for the parallel jets in paper by Lin & Sheu [1], the locations of Merging Point (M.P.) and Combining Point (C.P.) are closer to the inlet section (x=0) than those of inclined jets in paper by Wang et al. [2]. The figures reproduced from those two papers of experimental measurements are shown in the following Figure 1-4. In these figures, the space of the twin jets is S=60mm, and the width of the jet is D=2mm, thus S/D=30.

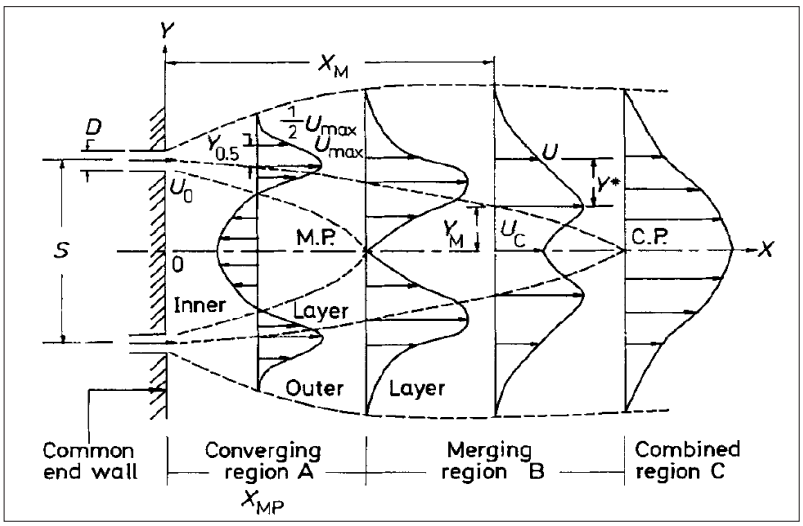

Figure 1: The notion defined in paper by Lin & Sheu [1] for parallel jets.

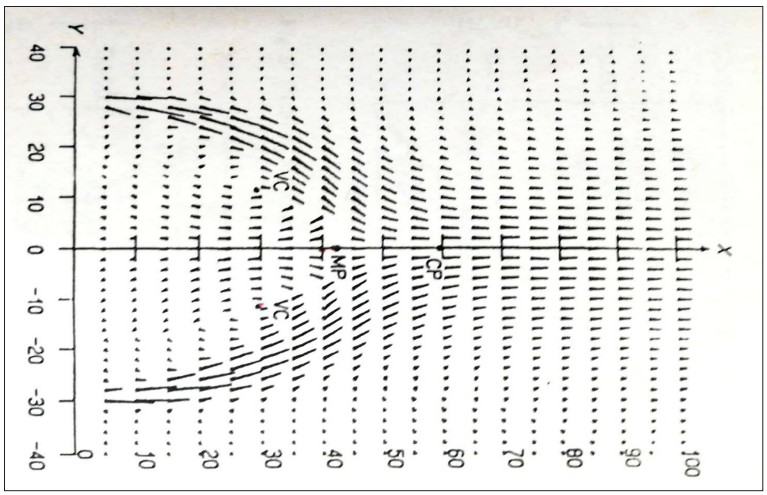

Figure 2: The location of M.P. and C.P. shown in the velocity distribution, from Figure 3 in paper by Lin & Sheu [1].

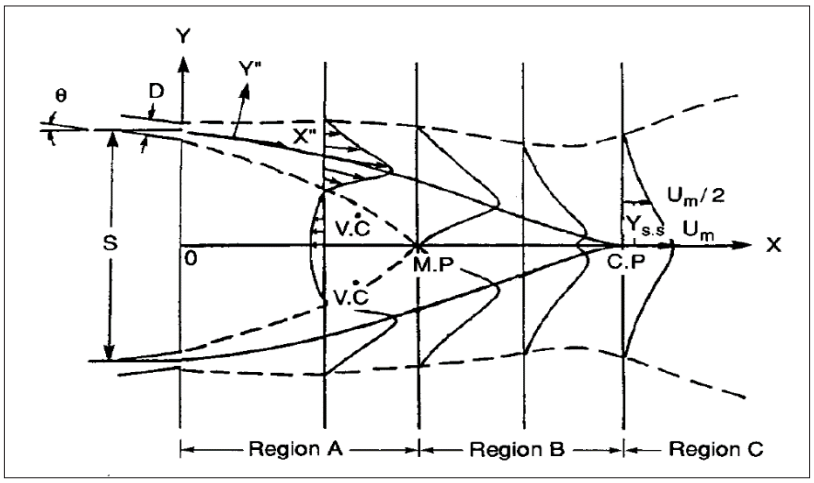

Figure 3: The notion defined in paper by Wang et al. [2] for inclined jets.

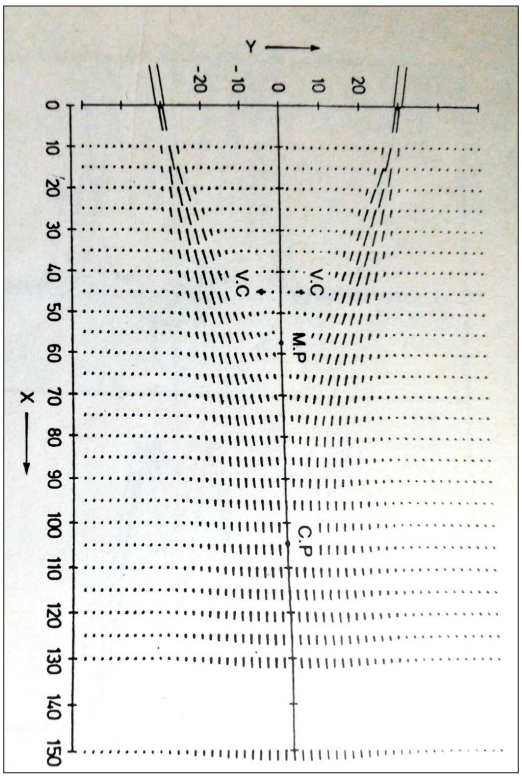

Figure 4: The location of M.P. and C.P. shown in the velocity distribution, from Figure 3 of paper by Wang et al. [2]. (For inclined angle, θ=9°)

According to the experimental results, the positions of vortex center (V.C.), merging point, and combining point of both parallel and inclined dual jets are listed in Table 1. It's interesting to find out that for the same experimental setup for inflow ($Q=10m^3/min$) and domain conditions, the positions, M.P. and C.P., of parallel dual-jet flow are closer to the inlet section (x=0) than those of inclined dual-jet flow. This result seems unreasonable and may need to be explained by the authors.

Table 1: Experimental measurements of V.C., M.P., and C.P. for S/D=30 with different inclined angels.

Inclined Angel	(Vortex Center, V.C.)		(Merging Point, M.P.)	(Combining Point, C.P.)
	X/D	Y/D	X/D	X/D
(θ=0°) Lin & Sheu [1]	15	6	22.5	30.5
(θ=9°) Wang et al. [2]	22.5	0.133	28.75	52.5

In this article, according to the experimental setup, the numerical simulation was carried out by the commercial code ANSYS Fluent [3]. The numerical simulation domain for parallel jets is shown in Figure 5.

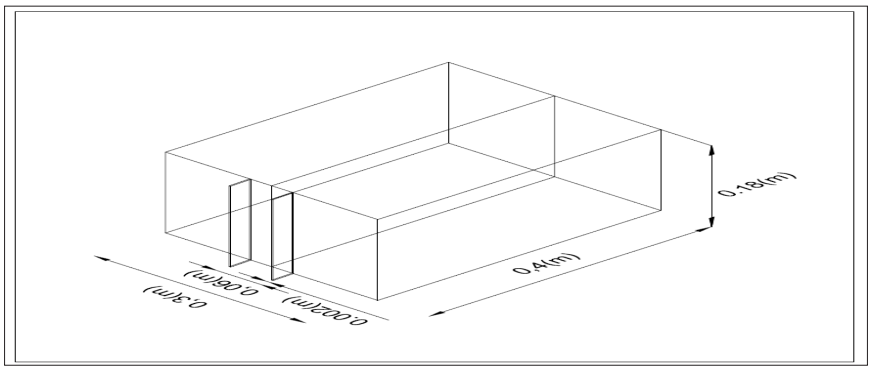

Figure 5: Domain of parallel jets for numerical simulation [3].

The comparison of numerical simulation and experimental measurements for parallel jets is shown in Table 2. For verification, it's found that the simulation results are closed to the experimental measurements in a reasonable discrepancy. After the verification of the numerical simulation for the parallel jets, the cases of inclined jets of 9˚, 18˚ and 27˚ are set up for further simulations. The comparison of results for experiment and simulation are shown in Table 3.

Table 2: Comparison of numerical simulation with the experimental measurements of the Vortex center, merging point, and Combining point for parallel jets, S/D=30.

Angel (θ=0˚)	(Vortex Center, V.C.)		(Merging Point, M.P.)	(Combining Point, C.P.)
	X/D	Y/D	X/D	X/D
Numerical simulation by Wan [3]	12	6.1	23.75	31.25
Experimental measurement by Lin & Sheu [1]	15	6	22.5	30.5

Table 3: For dual-jet flow with inclined inlet jets, V.C., M.P., and C.P. for S/D=30 of numerical simulation [3] and experimental measurement [2].

Angel (θ) X/D		(Vortex Center, V.C.)		(Merging Point, M.P.)	(Combining Point, C.P.)
		Y/D	X/D	X/D	
9˚	Experiment measurement [2]	22.5	0.133	28.75	52.5
	Numerical simulation [3]	13.1	5.9	21.5	30.5
18˚	Experiment measurement [2]	20	0.12	26.25	45
	Numerical simulation [3]	10.6	4.45	18.75	25
27˚	Experiment measurement [2]	14	0.1	20.05	30
	Numerical simulation [3]	8.15	4.6	16.5	23.75

In Table 3, the distance between both M.P. and C.P. to the inlet section (x=0) is reducing with increasing inclined angels for both experimental and numerical results. The numerical simulation of M.P. and C.P. is reasonable for comparing with the case of parallel jets. However, for the experimental values of M.P. and C.P. for inclined angel 9˚and 18˚ are still larger than the value of parallel jets. Therefore, there could exist some errors need to be explained in the paper by Wang et al. [2].

References

1. Lin YF, Sheu MJ (1990) Investigation of two plane parallel unventilated jets. Exp Fluids 10(1): 17-22.
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3. Wan DL (2018) Numerical study on the flow and concentration fields in two plane unventilated jets. Master thesis, Chung Yuan Christian University, Taiwan.