

TRANSPORT PHENOMENA & FLUID MECHANICS

“湍”“流”“动”“力”“学”“研”“究”“所”“研”“究”“生”“院”

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摘要: 一种数值方法被开发出来以直接模拟可压缩的、颗粒-湍流喷射。第四阶紧致差分格式被用来离散空间导数。拉格朗日方法被用来模拟颗粒运动, 基于单-way耦合。它被发现湍流强度剖面, 在射流下游区域, 随着 Stokes 数  $St$  的增加, 颗粒在射流边界处聚集。大的 Stokes 数颗粒在射流边界处分布最不均匀, 且侧向扩散最小。颗粒在射流中心 Stokes 数分布最均匀, 且侧向扩散最大。此外, 不同的初始条件对颗粒扩散有不同的影响。数值模拟 (DNS) 的结果与之前的实验和数值结果一致。

关键词: [湍流](#), [颗粒](#), [喷射](#), [直接模拟](#), [拉格朗日方法](#), [耦合](#)

DOI:

Direct Numerical Simulation of Particle Dispersion in Gas-Solid Compressible Turbulent Jet

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Abstract: A numerical method was developed to directly simulate the compressible, particle-laden turbulent jet. The fourth-order compact finite difference scheme was used to discretize the space derivatives. The Lagrangian method was adopted to simulate the particle motion based on one-way coupling. It is found that the turbulent intensity profiles attain self-similar states in the jet downstream region. As the Stokes number of  $St$  particles are concentrated largely in the outer boundaries of the large Stokes vortex structures with the most uneven distribution and the lowest dispersion in the lateral direction. Particles at the much smaller Stokes numbers are distributed evenly in the flow field, and the lateral dispersion is also considerable. Distribution of particles at much larger Stokes numbers is more uniform and the lateral dispersion becomes small. In addition, the initial conditions have different effects on the particle dispersion. The direct numerical simulation (DNS) results accord with the previous experiments and numerical results.

Key words: [turbulence](#), [particle](#), [jet](#), [direct numerical simulation](#), [Lagrangian method](#), [coupling](#)

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目次	
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	10
11	11
12	12
13	13
14	14
15	15
16	16
17	17
18	18
19	19
20	20
21	21
22	22
23	23
24	24
25	25
26	26
27	27
28	28
29	29
30	30
31	31
32	32
33	33
34	34
35	35
36	36
37	37
38	38
39	39
40	40
41	41
42	42
43	43
44	44
45	45
46	46
47	47
48	48
49	49
50	50
51	51
52	52
53	53
54	54
55	55
56	56
57	57
58	58
59	59
60	60
61	61
62	62
63	63
64	64
65	65
66	66
67	67
68	68
69	69
70	70
71	71
72	72
73	73
74	74
75	75
76	76
77	77
78	78
79	79
80	80
81	81
82	82
83	83
84	84
85	85
86	86
87	87
88	88
89	89
90	90
91	91
92	92
93	93
94	94
95	95
96	96
97	97
98	98
99	99
100	100