

Boundary Layer Flow About And Inside A Liquid Sphere

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ASME-AMER SOC MECHANICAL ENG, JOURNAL OF FLUIDS ENGINEERING-
TRANSACTIONS OF THE ASME; pp: 42-49; Vol: 119

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Summary

A finite-difference scheme has been developed to solve the boundary-layer equations governing laminar flows around and inside a spherical fluid droplet moving steadily in another immiscible fluid. Using this scheme, results not available in the literature have been obtained for circulating droplets at intermediate and high interior-to-exterior viscosity ratios (μ^*) and large values of the external flow Reynolds number (Re). Detailed results over the range 1.01 less than or equal to μ^* less than or equal to infinity (solid sphere) and 100 less than or equal to Re less than or equal to 10000 are presented for the velocity profiles outside and inside the droplet, the interface shear stress, the external flow separation angle, the droplet surface velocity and the drag coefficient.

References:

1. ABDELALIM AH, 1975, IND ENG CHEM FUND, V14, P308
2. BATCHELOR GK, 1967, INTRO FLUID DYNAMICS
3. BRABSTON DC, 1975, J FLUID MECH, V69, P179
4. CHAO BT, 1962, PHYS FLUIDS, V5, P69
5. DANDY DS, 1989, J FLUID MECH, V208, P161
6. DENNIS SCR, 1971, J FLUID MECH, V48, P771
7. ELSHAARAWI MAI, 1985, J FLUID ENG-T ASME, V107, P97
8. ELSHAARAWI MAI, 1987, J FLUID ENG-T ASME, V109, P75
9. ELSHAARAWI MAI, 1987, J NUMERICAL METHODS, V7, P825
10. HADAMARD MJ, 1911, CR HEBD ACAD SCI, V152, P1735
11. HAMIELEC AE, 1962, CAN J CHEM ENGNG, V40, P41
12. HAMIELEC AE, 1963, CAN J CHEM ENGNG, V41, P246
13. HAMIELEC AE, 1967, AICHE J, V13, P212
14. HAMIELEC AE, 1967, AICHE J, V13, P220
15. HARPER JF, 1968, J FLUID MECH, V32, P367

16. HARPER JF, 1972, ADV APPL MECH, V12, P59
17. HARPER JF, 1972, J FLUID MECH 2, V32, P59
18. LECLAIR BP, 1972, J ATMOSPHERIC SCI, V29
19. LEVICH VG, 1962, PHYSICOCHEMICAL HYDR
20. MOORE DW, 1959, J FLUID MECH, V6, P113
21. MOORE DW, 1963, J FLUID MECH, V16, P161
22. NAKAMURA I, 1976, PHYS FLUIDS, V19, P5
23. NAKANO Y, 1967, CAN J CHEM ENG, V45, P135
24. OLIVER DL, 1985, J FLUID MECH, V54, P215
25. OLIVER DLR, 1987, J FLUID MECH, V177, P1
26. POZRIKIDIS C, 1989, J FLUID MECH, V209, P77
27. RIVKIND VY, 1976, APPL MATH MECH, V40, P687
28. RIVKIND VY, 1976, FLUID DYN, V11, P5
29. RYBZYNSKI W, 1911, B INT ACAD SCI CRA A, V1, P44
30. RYSKIN G, 1984, J FLUID MECH, V148, P1
31. RYSKIN G, 1984, J FLUID MECH, V148, P19
32. RYSKIN G, 1984, J FLUID MECH, V148, P37
33. SCHLICHTING H, 1979, BOUNDARY LAYER THEOR
34. WINNIKOW S, 1966, PHYS FLUIDS, V9, P50

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