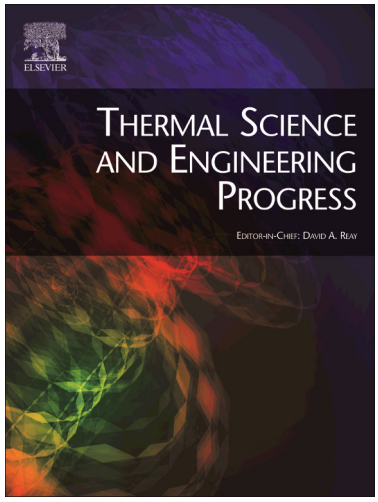


# Closed Form Analytic Solutions to Heat and Mass Transfer Characteristics of Wall Jet Flow of Nanofluids

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# Closed Form Analytic Solutions to Heat and Mass Transfer Characteristics of Wall Jet Flow of Nanofluids

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**Abstract**

In the present work, an interesting and simple analytic solution to wall jet flow of nanofluids is presented. The concept of exponentially decaying wall jet flows (those integral constraint proposed by Glauert is retained) is targeted. A general scheme for momentum similarity equation is considered in which the effects of suction together with moving wall are allowed. A parametric two-phase modeling framework is brought into account to study the wall jet flow of nanofluids. The only simplification is with respect to thermophoresis effect elimination which in particular reveals some facts regarding the effectiveness of boundary conditions for particle transport equation. In this regard, a brief discussion is initially provided as may be of help to a better understanding of the nanoparticles behavior at the wall. Finally, closed form analytic expressions are obtained for heat and mass transfer characteristics of wall jet flow of nanofluids. It is hopeful that the rate of heat and mass transfer as well as temperature and concentration distributions can be better understood by the means of the presented formulae.

**Keywords**

Wall Jet Flow of Nanofluids; Exact Closed Form Solution to Heat and Mass Transfer Characteristics; Similarity Solution; Two-Phase Modeling

**Nomenclature**

| | | | |
|---|---|---|---|
| $u$ | X- Component Velocity | $T$ | Temperature |
| $v$ | Y- Component Velocity | $C$ | Concentration |
| $\psi$ | Stream Function | $D_T$ | Thermophoresis Diffusion rate |
| $\upsilon$ | Kinematic Viscosity | $\alpha$ | Thermal Diffusivity |
| $U_0$ | Reference Velocity | Pr | Prandtl Number |
| $M$ | Dimensionless Flux of Exterior Momentum Flux | $Sc$ | Schmidt Number |
| $\tau$ | $(\rho C_p)_{np} / (\rho C_p)_{bf}$ | $N_t$ | Thermophoresis Parameter |
| $D_B$ | Brownian Diffusion Rate | $N_b$ | Brownian Parameter |

## Introduction

To start, it is worth mentioning Glauert as the pioneer who first introduced the wall jet [1]. The similarity solution for such a flow proposed once by Glauert was subject to a fixed wall