

**STUDY ON PARTICLE SHAPE ON MICROPOLAR NANOFLUIDS OVER AN
EXPONENTIALLY STRETCHING SHEET IN A POROUS MEDIUM USING
OPTIMAL HOMOTOPY ANALYSIS METHOD**

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This study explores the impact of nanoparticle geometry on micropolar nanofluid flow over an exponentially stretching sheet in a porous medium, incorporating the micro-rotation profile. Using the fourth-order Runge-Kutta Integration Method, Murugesan and Kumar (2019) analyzed this flow system without considering micro-rotation effects. This study extends their work by employing the Optimal Homotopy Analysis Method (OHAM) to analyze the hydromagnetic behaviour of nanofluids by considering the micro-rotation profile. Three nanoparticle shapes: cylindrical, spherical, and lamina, are considered, using silver nanoparticles suspended in water as the base fluid. The governing partial differential equations (PDEs) are transformed into a dimensionless system of ordinary differential equations (ODEs) via similarity transformations, and solved using OHAM. The Mathematica package BVPH 2.0, developed by Liao, is utilized for numerical computations. A key advantage of OHAM lies in its flexibility in selecting the initial approximation and auxiliary linear operator, enabling the transformation of a nonlinear system into an infinite series of linear sub-problems. The study examines fluid velocity, temperature distribution, micro-rotation, and concentration profiles to evaluate heat and mass transport characteristics. A tenth-order approximation solution is obtained to demonstrate error analysis, reinforcing OHAM as a robust and reliable method for solving nonlinear fluid dynamics problems. The obtained results confirm the accuracy and efficiency of OHAM, yielding higher-order approximations with minimal errors.

Keywords: Exponentially stretching sheet, Geometrical shape, Homotopy analysis method, Micropolar nanofluid, Porous medium