Characteristics of sodium alginate-based hybrid nanofluid and darcy-forchheimer flow induced by stretching surface with thermal radiation and cattaneo–christov heat flux model	
Authors	**Umar Farooq, Chemseddine Maatki, Karim Kriaa, Bilel Hadrich, Muhammad Imran, Sobia Noreen, Hassan Waqas, Ali Akgül**
Publication Year	2024
Grant Number	IMSIU-RP23057
DOI link	10.1016/j.jocs.2024.102209

Abstract: Hybrid nanofluids are enhanced nanofluids with purportedly greater thermal characteristics than basic nanofluids. These unique nanofluids are created by combining nanomaterials of two or more distinct materials of the same or different sizes in a typical fluid. The "hybrid nanofluids" display enhanced thermal properties above basic nanofluids, which have been linked to 'synergistic processes'. Synergistic effects are qualities that develop at the microscopic level as a result of molecular interactions, resulting in a combined impact that is higher than the individual influence of any one particle. Small amounts of metal nanoparticles introduced into an oxide or metal nanostructure and then embedded in a base liquid increase its thermal characteristics unexpectedly. The high thermal conductivity, solidity, and increased heat flow properties of "hybrid nanofluids" are all qualities. Superior heat conductivity means more vitality efficiency, reduced running costs, and better execution. Only a few of the programs for hybrid nanofluids include improved heat management in electricity-generating equipment and appliances like generators, transformers, heat pumps, and refrigerators for more effective space cooling and heating, and improved heat transfer in complex systems including spacecraft, medical laboratories, nuclear stations, and so on. Because of its huge range of applications in biomedicine, heat exchangers, cooling of electronic devices, double windowpane, transportation, food production, and other fields, the notion of nanofluids has become a more expansive topic for researchers in recent years. To increase the thermal conductivity of common fluids such as ethylene glycol, water, kerosene, and motor oils, different types of nanoparticles including graphene, silicon dioxide, silver, platinum, cobalt, aluminum oxide, carbon nanotubes, and so on must be added to the base fluids. A large number of research publications dealing with the increase of base fluid thermal conductivity by adding various types of nanoparticles have been identified in a review of the literature. Choi and Eastman [1] pioneered the study of thermal conductivity in nanofluids. Panda et al. [2] investigated heat transfer features in hybrid nanofluid flow with wall temperature flowing through a wedge. Tayari et al. [3] investigated the role of CNTs in hybrid nanofluids. Farooq et al…..