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A thermodynamically consistent model for convective transport in nanofluids

Abstract:

We present a mathematical model for convective transport in nanofluids including thermophoretic effects that is very similar to the celebrated model of Buongiorno. Our model, however, is thermodynamically consistent and consequently an energy estimate can be shown. We propose a semi-discretization in time that fully decouples the subproblems.

Also for this semi-discrete problem an energy estimate can rigorously be shown. Based on this energy estimate it is proved that solutions of the semi-discrete problem converge to a weak solution of the system.

For the stationary system, regularity as well as optimal error estimates for finite element approximations can be shown under some smallness assumptions.