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Effect of the macroscopic local inertial term on the non-Newtonian free-convection flow in channels filled with porous materials

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Abstract: The transient behavior of non-Newtonian free-convection flow in openended vertical parallel-plate channels filled with porous materials is investigated numerically. The role of the macroscopic local inertial term in the momentum equation is studied. It is found that the effect of the macroscopic local inertial term becomes more significant as the power law index n and the modified Darcy number Da* increase, and as the modified Forchheimer ?? and Fourier ?? numbers decrease. The macroscopic local inertial term plays no role when Da* < 104 over the entire ranges of n, ??, and ??. Also, it is found that the macroscopic local inertial term plays no role when ?? > 104 over wide ranges of Da*, ??, and n. The modified Fourier number ?? has insignificant effect on the channel transient behavior at large values of ??. It is found that the effect of the macroscopic local inertial term is very sensitive to the Forchheimer number at high values of Darcy number and power law index. Also, there is an upper limit for n, beyond which changing the power law index has insignificant effect on the local inertial term.