HEAT CONDUCTION IN A ONE-DIMENSIONAL SYSTEM BY THE CONTINUOUS TIME RANDOM WALK METHOD

Ederson Pauletti, Pedro Pablo González-Borrero, Eduardo Vicentini
Universidade Estadual do Centro-Oeste - UNICENTRO

This work presents the analysis of the heat conduction in a one-dimensional system through the continuous time random walk (CTRW) method, with the purpose of relating the properties which thermically characterize the medium, namely the thermal capacity and conductivity with the microscopic properties, that is, free mean path and mean time between collisions. These microscopic properties are mainly related to the motion of phonons in semiconductors or the conduction electrons in conductors. The system was considered with limited length, with two sources of constant temperature (T_0 and T_1) in both extremities, being $T_1 > T_0$. Along the development of the CTRW method, it was used an exponential function for the time probability density between collisions and the Gaussian function for the jump length probability density, being these two functions not connected. The two distributions lead to the Gaussian function for the probability density of localization of the random walker at time t. The results show the temperature distribution at the transient regime and the normal diffusion that lead the transient process to the stationary regime of temperature. The results are compared with the values found in literature for different materials such as conductors and semiconductors. It is expected that these results will contribute to the study of heat propagation in systems of small dimension and nanofluids.