


CHATCHAWAN WATCHARARUANGWIT : DEVELOPMENT OF
A DETERMINISTIC SPECTRAL METHOD FOR SOLVING THE
NONLINEAR BOLTZMANN KINETIC EQUATION. THESIS
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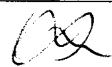
BOLTZMANN EQUATION/MAXWELLIAN MODEL/FOURIER
TRANSFORM/HANKEL TRANSFORM/HEAT TRANSFER PROBLEM

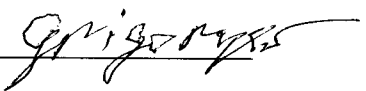
A new deterministic numerical method for solving the kinetic Boltzmann equation of Maxwell molecules with cylindrical symmetry in the velocity space is developed. Using the splitting method with respect to physical processes, the Boltzmann equation is decomposed into the space homogeneous Boltzmann equation and the transport equation. The transport equation is solved by either Lax-Wendroff or upwind schemes. For Maxwell's model, the space homogeneous Boltzmann equation is simplified by Fourier transform with respect to velocity. Because of the cylindrical symmetry in the velocity space, the three-dimensional Fourier transform is equivalent to a one-dimensional Fourier transform and a Hankel transform. An exponential grid in velocity space allows applying an effective FFT algorithm to computing the Hankel transform. The space homogeneous Boltzmann equation in Fourier space is solved by the Runge-Kutta scheme. The new method is applied to solve the heat transfer problem and recondensation problem between parallel plates.

School of Mathematics

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