

runs developed with the meteorological model WRF (NCAR, US) and building structures from geographic information databases. The model outputs are: sun location in Cartesian coordinates; grid cells in shadow and sun; sky view factor in every grid cell; direct and diffuse partition; and finally, the total short wave radiation by each grid cell.

Sky view factor and reflections are calculated using a three-dimensional ray tracking method. It consists in casting rays from an hemisphere located on the center of each grid cell and count the number of rays that collide with the buildings. In $1km \times 1km$ model domain, around 35000-50000 rays are needed. It is a high demand computing process so it is implemented following a distributed memory parallel approach (Message Passing Interface MPI). Some details about the speed-up of the algorithm will be presented in this paper. Direct and diffuse radiation partition is made taking into account the solar zenith angle and the sky conditions (cloudless conditions or cover conditions). The direct radiation is affected by the shadow and diffuse by the sky view factor. The total short wave radiation by each grid cell is calculated by an iterative method. After an initial solar radiation map (ISR), m reflections are calculated until the increment is less than 1% of the ISR. The data produced by the urban solar radiation model has been used in large scale numerical experiments to simulate turbulent fluxes for urban areas, over Madrid (Spain) city. We have applied a modified version of the EULAG (UCAR) micro scale model (CFD) which includes an energy balance equation to obtain the urban energy exchange. Results of the micro scale simulations and how sensitivity are the results to the solar radiation approach will be presented in this paper.

Phonon-Induced Decoherence in Electron Evolution

P. Schwaha, M. Nedjalkov, S. Selberherr, I. Dimov

The Wigner-Boltzmann equation has been conveniently applied to study the behaviour of an electron interacting with a potential field and thermal vibrations (phonons) of the semiconductor lattice. The stationary electron transport is determined by the boundary conditions and clearly reveals processes of decoherence and localization due to the phonons.

We study the transient process of decoherence of a freely evolving (constant potential) electron interacting with a surrounding phonon bath. The initial electron state is determined by the entanglement of two wave packets. An example of the Wigner function corresponding to entangled wave packets is shown in Figure 1. An initially entangled phase space configuration is evolved numerically using a Monte Carlo approach. The investigation aims to identify the time scale of the evolution as well as the influence of the phonon energy and the electron-phonon coupling by varying the related physical parameters.

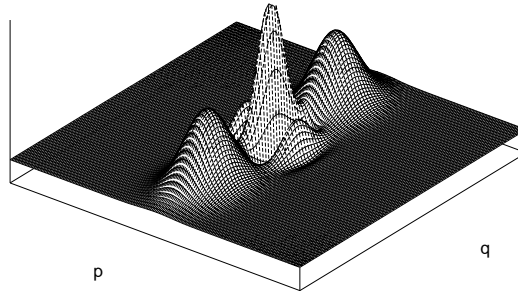


Figure 1: Entangled wave packets as used for the initial setup.

A Parallel Algorithm with Improved Performance of Finite Volume Method (SIMPLE-TS)

K. S. Shterev, S. K. Stefanov, E. I. Atanassov

In this paper a reorganisation of parallel version of the finite volume method SIMPLE-TS for calculation of two-dimensional compressible, viscous gas flows is presented. It is demonstrated on a problem addressed to the new emerging area of the micro gas flows, taking place in Micro-Electro-Mechanical Systems (MEMS). The goal of the reorganisation of the parallel algorithm is to improve the algorithm performance in runs, when more cores are used for calculations on grids with relatively small number of cells. The reorganisation is two-fold: first to reduce the number of communications between the processes, and second to reorder the calculation of some variables in such a way that increases the number of calculations during the duration of the communications between the processes. The comparison of speedups between previous and new parallel versions of SIMPLE-TS was performed on two types of clusters with regard to the communication hardware: the first uses specialised cards with low latency for the interconnections between the computers and the other uses conventional cards for the interconnections. The clusters are a part of the GRID-infrastructure of the European Research Area (ERA).