UNIVERSITY OF OTTAWA

Discrete-Velocity Scheme Project

Mathieu Marchildon

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Shock-Tube Problem

For the initial conditions of the shock-tube we must select an appropriate velocity space. This velocity space can be determined by observing the distribution function on each side of the shock tube for both initial conditions. The distribution function in velocity space can be determined by applying Maxwell-Boltzmann distribution for various ranges in velocity space.

$$f = \frac{\rho}{m} \left(\frac{\rho}{2\pi p} \right)^{\frac{1}{2}} e^{\frac{\rho}{2p} c^2}$$
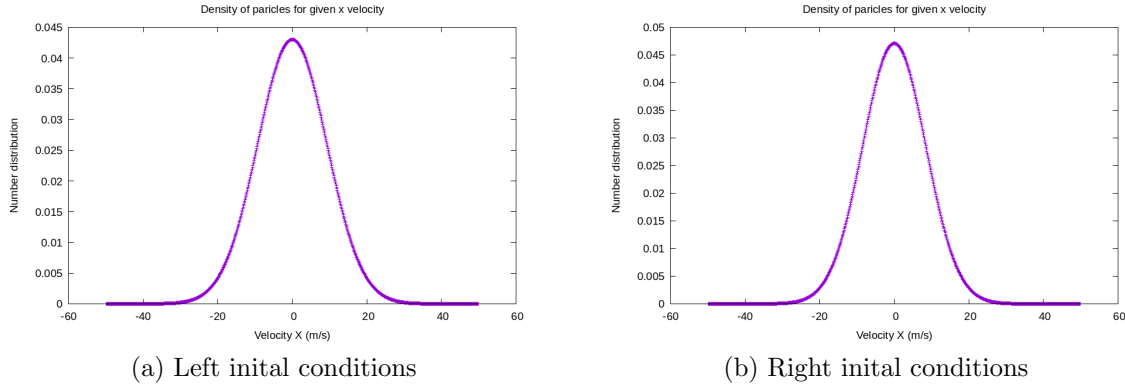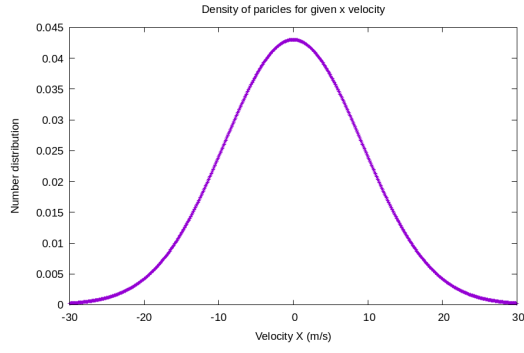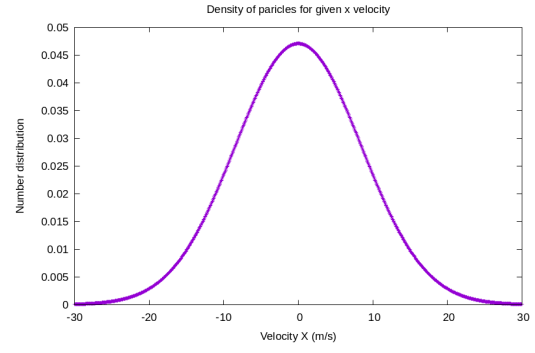

(a) Left inital conditions   (b) Right inital conditions

Figure 1: Distribution function at initial conditions
velocity range of $\pm 50\,\mathrm{m\,s^{-1}}$

Figure 1 shows the distribution function for the left and right initial conditions. The velocity space selected was ranging from $-50\,\mathrm{m\,s^{-1}}$ to $50\,\mathrm{m\,s^{-1}}$ This range of velocity seem way too large as the number density is near zero at the $30\,\mathrm{m\,s^{-1}}$ range

(a) Left inital conditions

(b) Right inital conditions

Figure 2: Distribution function at initial conditions
velocity range of $\pm 30\,\mathrm{m\,s^{-1}}$

Selecting a velocity range of $\pm 30\,\mathrm{m\,s^{-1}}$, as shown in 2 we obtain a more refined velocity space. Such that we are not computing properties of particles who's number density is near zero.