

01. Introduction to the PIC simulation

02. Random number generation and its application

03. Particle weighting and normalization

04. Particle pusher

05. Poisson's equation

06. One-dimensional electrostatic PIC code

07. Numerical tips and tricks in PIC simulations

08. Visualization

Particle-in-Cell (PIC) kinetic simulations

09. Electromagnetic field solver

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www.slido.com code: #B194

Maxwell's equations (1D)

$$\nabla \cdot \vec{E} = \frac{\rho_c}{\epsilon_0}$$

$$\frac{\partial E_x}{\partial x} = \frac{\rho_c}{\epsilon_0}$$

$$\frac{\partial}{\partial y} = \frac{\partial}{\partial z} = 0$$

$$\nabla \cdot \vec{B} = 0$$

$$\frac{\partial B_x}{\partial x} = 0$$

$$B_x = \text{const}$$

$$\nabla \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}$$

$$-\frac{\partial E_z}{\partial x} = -\frac{\partial B_y}{\partial t}$$

$$\frac{\partial E_y}{\partial x} = -\frac{\partial B_z}{\partial t}$$

$$\nabla \times \vec{B} = \mu_0 \vec{J} + \frac{1}{c^2} \frac{\partial \vec{E}}{\partial t}$$

$$-\frac{\partial B_z}{\partial x} = \mu_0 J_y + \frac{1}{c^2} \frac{\partial E_y}{\partial t}$$

$$\frac{\partial B_y}{\partial x} = \mu_0 J_z + \frac{1}{c^2} \frac{\partial E_z}{\partial t}$$

Maxwell's equations (2D)

$$\nabla \cdot \vec{B} = 0$$

$$\frac{\partial B_x}{\partial x} + \frac{\partial B_y}{\partial y} = 0$$

$$\frac{\partial}{\partial z} = 0$$

$$\nabla \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}$$

$$\frac{\partial E_z}{\partial y} = -\frac{\partial B_x}{\partial t}$$

$$-\frac{\partial E_z}{\partial x} = -\frac{\partial B_y}{\partial t}$$

$$\frac{\partial E_y}{\partial x} - \frac{\partial E_x}{\partial y} = -\frac{\partial B_z}{\partial t}$$

$$\nabla \times \vec{B} = \mu_0 \vec{J} + \frac{1}{c^2} \frac{\partial \vec{E}}{\partial t}$$

$$\frac{\partial B_z}{\partial y} = \mu_0 J_x + \frac{1}{c^2} \frac{\partial E_x}{\partial t}$$

$$-\frac{\partial B_z}{\partial x} = \mu_0 J_y + \frac{1}{c^2} \frac{\partial E_y}{\partial t}$$

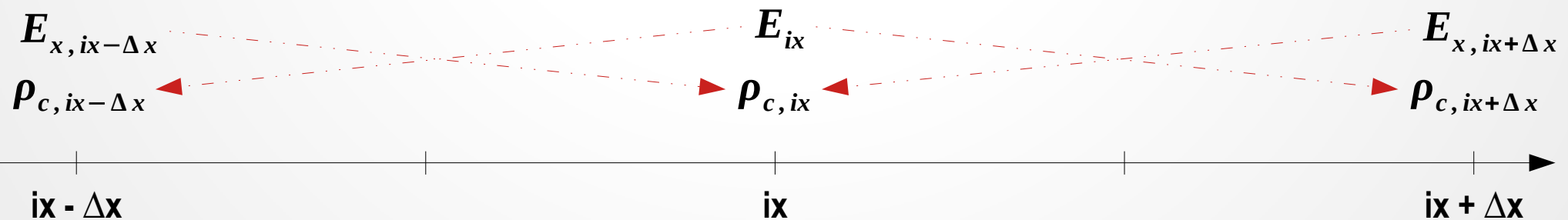
$$\frac{\partial B_y}{\partial x} - \frac{\partial B_x}{\partial y} = \mu_0 J_z + \frac{1}{c^2} \frac{\partial E_z}{\partial t}$$

Maxwell's equations (1D)

$$\frac{\partial E_x}{\partial x} = \frac{\rho_c}{\epsilon_0}$$

$$\frac{\partial}{\partial y} = \frac{\partial}{\partial z} = 0$$

$$\frac{E_{x,ix+\Delta x} - E_{x,ix-\Delta x}}{2\Delta x} = \frac{\rho_{c,ix}}{\epsilon_0}$$

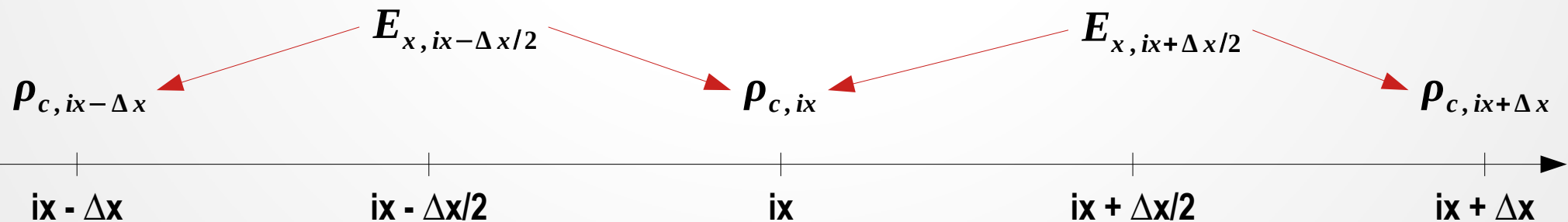


Maxwell's equations (1D)

$$\frac{\partial E_x}{\partial x} = \frac{\rho_c}{\epsilon_0}$$

$$\frac{\partial}{\partial y} = \frac{\partial}{\partial z} = 0$$

$$\frac{E_{x,ix+\Delta x/2} - E_{x,ix-\Delta x/2}}{\Delta x} = \frac{\rho_{c,ix}}{\epsilon_0}$$



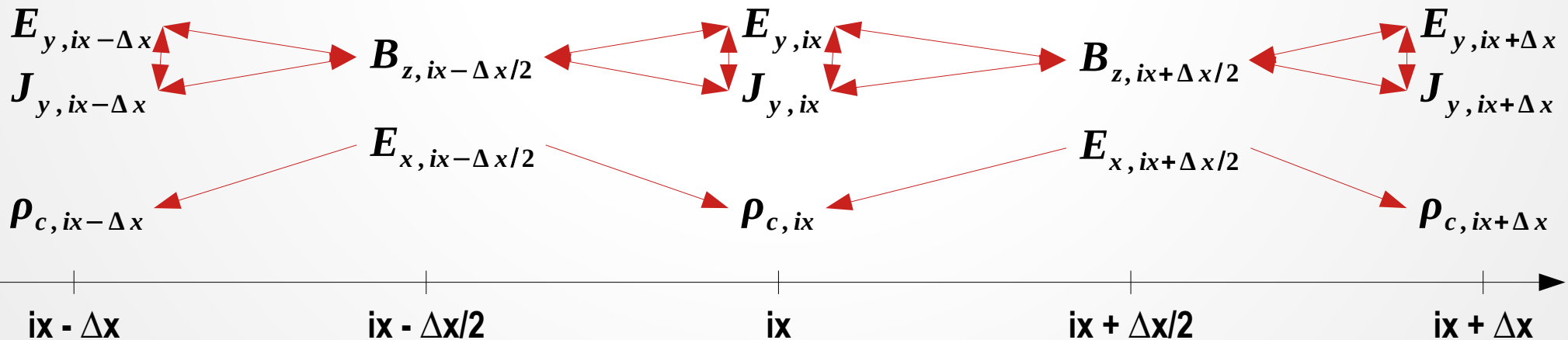
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