

# BUNEMAN - BORIS C ALGORITAM

$n=0$  (POČETNO)

$$v^n = \sqrt{v_x^2 + v_y^2 + v_z^2}$$

$$\gamma^n = \frac{1}{\sqrt{1 - v^2/c^2}}$$

$$\vec{u}^n = \gamma^n \vec{v}^n$$

$$\vec{r}^{n+1/2} = \vec{r}^n + \frac{\Delta t}{2} \frac{\vec{u}^n}{\gamma^n}$$

$$\vec{u}^- = \vec{u}^n \left[ + \frac{e \Delta t}{2m} \vec{E}(\vec{r}^{n+1/2}) \right]$$

$$\gamma^- = \sqrt{1 + u^{-2}/c^2}, \quad u^{-2} = u_x^{-2} + u_y^{-2} + u_z^{-2}$$

$$\Theta = \frac{e \Delta t}{m \gamma^-} B, \quad B = \|\vec{B}(\vec{r}^{n+1/2})\|$$

$$\vec{b} = \frac{\vec{B}}{\|\vec{B}\|}, \quad \vec{B} \equiv \vec{B}(\vec{r}^{n+1/2})$$

$$\vec{u}_{||} = (\vec{u}^- \cdot \vec{b}) \vec{b} \quad \begin{matrix} \text{|| n.p. dot} \\ \text{|| n.p. cross} \end{matrix} \quad \begin{matrix} \text{|| n.p. sin} \\ \text{|| n.p. cos} \end{matrix}$$

$$\vec{u}^+ = \vec{u}_{||} + (\vec{u}^- - \vec{u}_{||}) \cos \Theta + (\vec{u}^- \times \vec{b}) \sin \Theta$$

$$\vec{u}^{n+1} = \vec{u}^+ \left[ + \frac{e \Delta t}{2m} \vec{E}(\vec{r}^{n+1/2}) \right]$$

$$\gamma^{n+1} = \sqrt{1 + u^{n+1 2}/c^2}, \quad u^{n+1 2} = u_x^{n+1 2} + u_y^{n+1 2} + u_z^{n+1 2}$$

$$\vec{v}^{n+1} = \vec{u}^{n+1} / \gamma^{n+1}$$

$$\vec{r}^{n+1} = \vec{r}^{n+1/2} + \frac{\Delta t}{2} \frac{\vec{u}^{n+1}}{\gamma^{n+1}}$$

ZA DIPOLNO MAGNETNO  
POJE KOJE SE NE MENJA  
TOKOM VREMENA  $\Rightarrow \vec{E}$  SE  
IZOSTAVJA