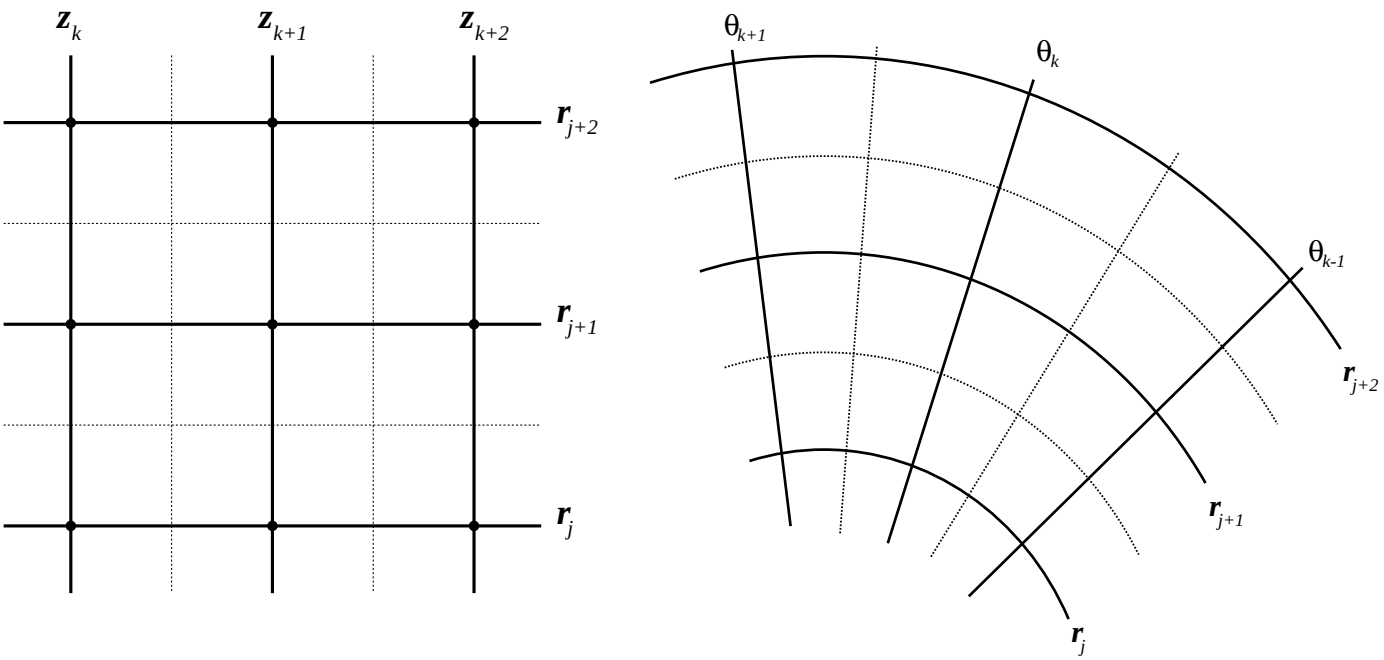
Weightings in $r - z$ and $r - \theta$



- Asuume uniform spacings

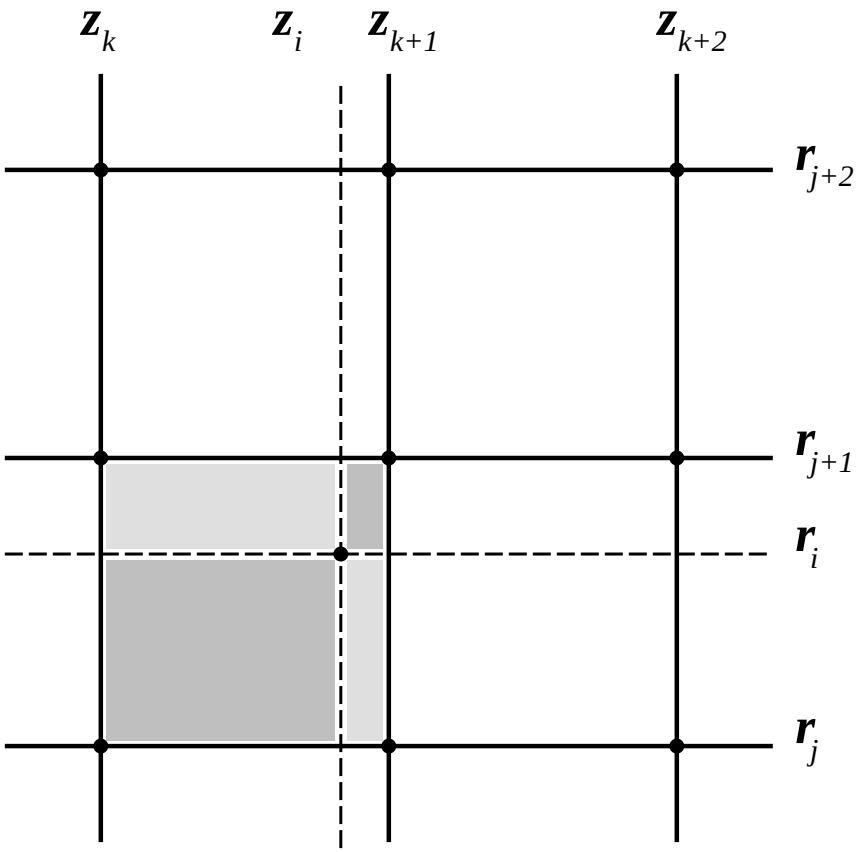
$$r_{j+1} - r_j = \Delta r_j = \Delta r,$$

$$z_{k+1} - z_k = \Delta z_k = \Delta z,$$

$$\theta_{k+1} - \theta_k = \Delta\theta_k = \Delta\theta.$$

- Assume no center electrode, *i.e.* $r_j = j\Delta r$.

Particle-In-Cell (r-z weighting)



$w_r = r_i - r_j$

$w_z = z_i - z_k$

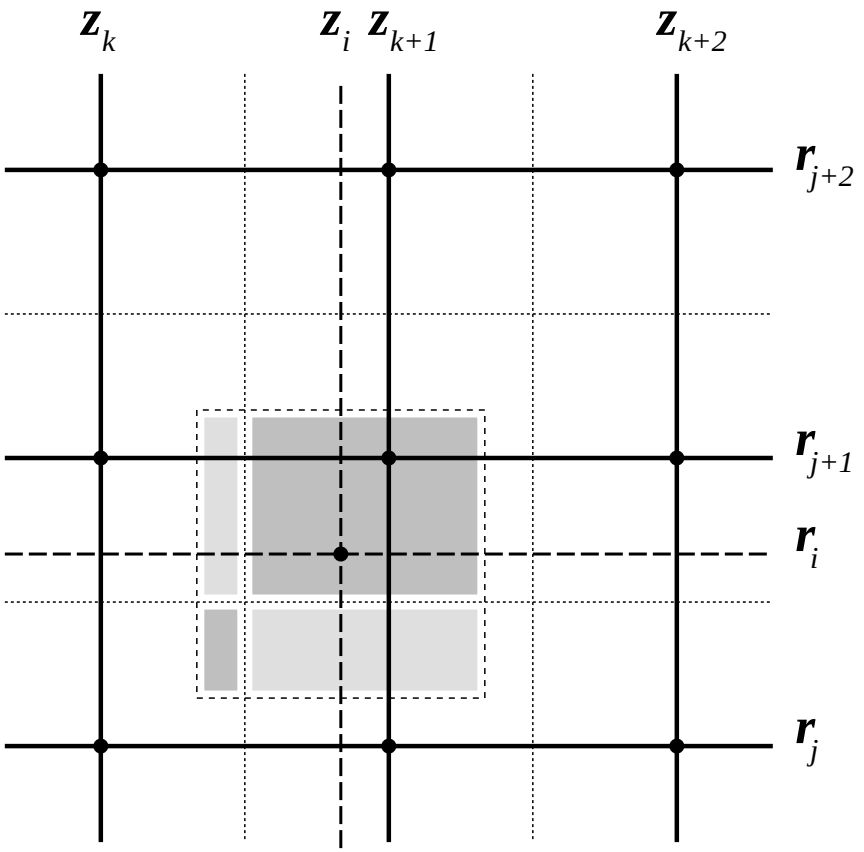
$$(j,k): \quad \frac{(r_{j+1}-r_i)(z_{k+1}-z_i)}{\Delta r \Delta z} \longrightarrow (1-w_r)(1-w_z)$$

$$(j,k+1): \quad \frac{(r_{j+1}-r_i)(z_i-z_k)}{\Delta r \Delta z} \longrightarrow (1-w_r)w_z$$

$$(j+1,k+1): \quad \frac{(r_i-r_j)(z_i-z_k)}{\Delta r \Delta z} \longrightarrow w_r w_z$$

$$(j+1,k): \quad \frac{(r_i-r_j)(z_{k+1}-z_i)}{\Delta r \Delta z} \longrightarrow w_r(1-w_z)$$

Cloud-In-Cell (r-z weighting)



$w_r = r_i - r_j$

$w_z = z_i - z_k$

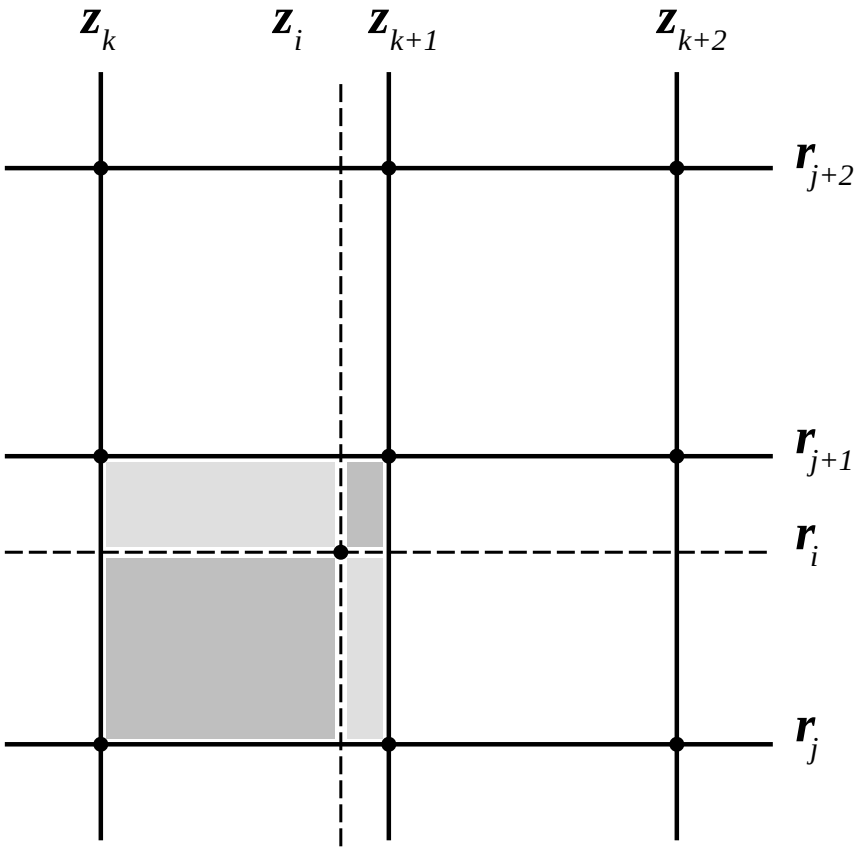
$$(j,k): \quad \frac{(r_{j+1/2}-r_{i-1/2})(z_{k+1/2}-z_{i-1/2})}{\Delta r \Delta z} \longrightarrow (1-w_r)(1-w_z)$$

$$(j,k+1): \quad \frac{(r_{j+1/2}-r_{i-1/2})(z_{i+1/2}-z_{k+1/2})}{\Delta r \Delta z} \longrightarrow (1-w_r)w_z$$

$$(j+1,k+1): \quad \frac{(r_{i+1/2}-r_{j+1/2})(z_{i+1/2}-z_{k+1/2})}{\Delta r \Delta z} \longrightarrow w_r w_z$$

$$(j+1,k): \quad \frac{(r_{i+1/2}-r_{j+1/2})(z_{k+1/2}-z_{i-1/2})}{\Delta r \Delta z} \longrightarrow w_r(1-w_z)$$

Particle-In-Cell (r^2-z weighting)



$r_j = j\Delta r \ , \ z_k = k\Delta z$

$r_i = R\Delta r \ , \ z_i = Z\Delta z$

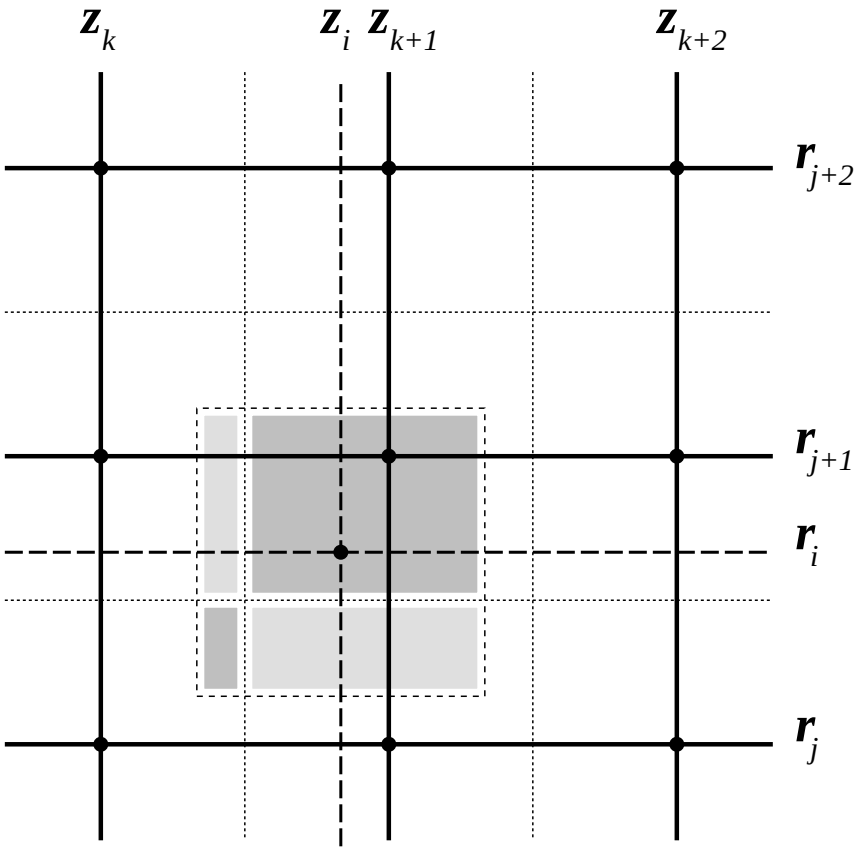
$$(j,k): \quad \frac{\pi(r_{j+1}^2-r_i^2)(z_{k+1}-z_i)}{\pi(r_{j+1}^2-r_j^2)\Delta z} \longrightarrow \frac{(j+1+R)(j+1-R)(k+1-Z)}{2j+1}$$

$$(j,k+1): \quad \frac{\pi(r_{j+1}^2-r_i^2)(z_i-z_k)}{\pi(r_{j+1}^2-r_j^2)\Delta z} \longrightarrow \frac{(j+1+R)(j+1-R)(Z-k)}{2j+1}$$

$$(j+1,k+1): \quad \frac{\pi(r_i^2-r_j^2)(z_i-z_k)}{\pi(r_{j+1}^2-r_j^2)\Delta z} \longrightarrow \frac{(R+j)(R-j)(Z-k)}{2j+1}$$

$$(j+1,k): \quad \frac{\pi(r_i^2-r_j^2)(z_{k+1}-z_i)}{\pi(r_{j+1}^2-r_j^2)\Delta z} \longrightarrow \frac{(R+j)(R-j)(k+1-Z)}{2j+1}$$

Cloud-In-Cell (r^2-z weighting)



$$r_j = j\Delta r \ , \ z_k = k\Delta z$$

$$r_i = R\Delta r \ , \ z_i = Z\Delta z$$

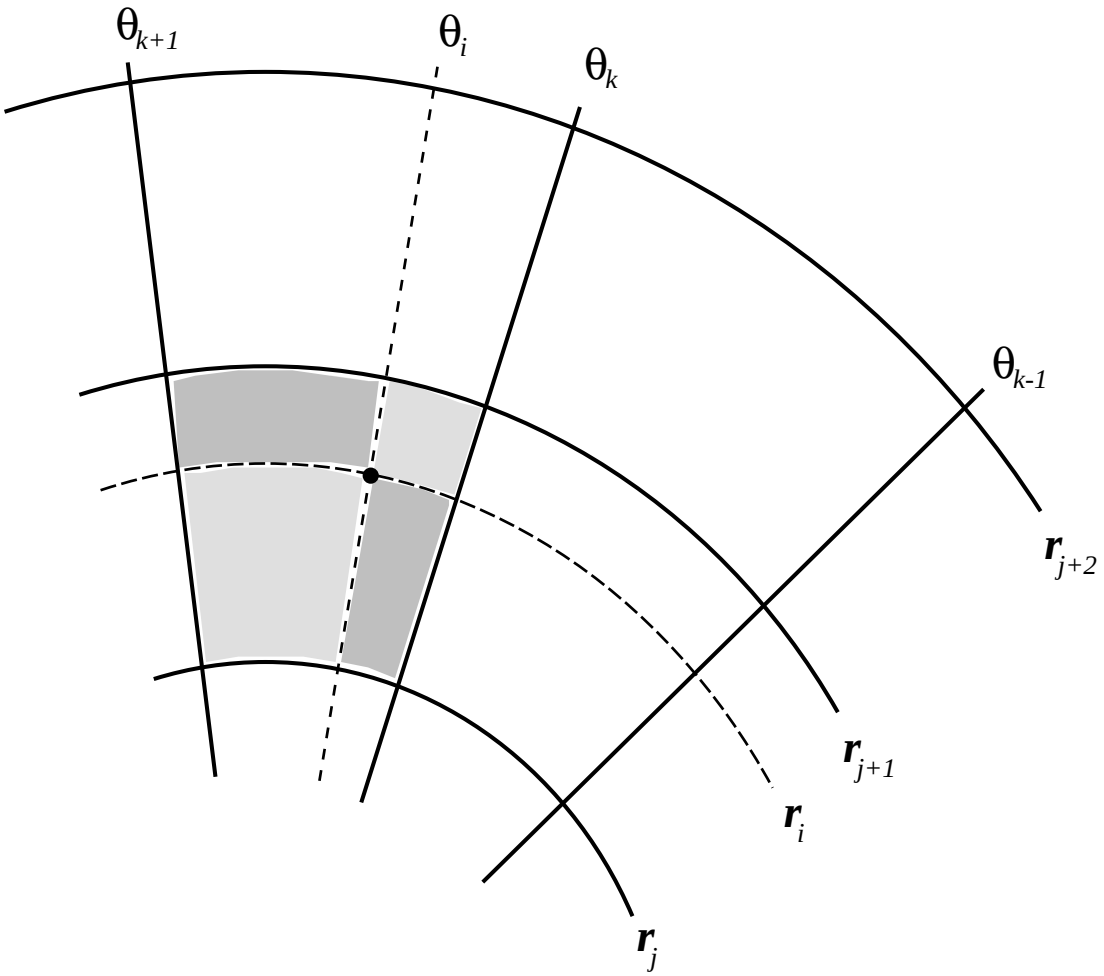
$$(j,k): \quad \frac{\pi(r^2_{j+1/2}-r^2_{i-1/2})(z_{k+1/2}-z_{i-1/2})}{2\pi r_i \Delta r \Delta z} \longrightarrow \frac{(R+j)(j+1-R)(k+1-Z)}{2R}$$

$$(j,k+1): \quad \frac{\pi(r^2_{j+1/2}-r^2_{i-1/2})(z_{i+1/2}-z_{k+1/2})}{2\pi r_i \Delta r \Delta z} \longrightarrow \frac{(R+j)(j+1-R)(Z-k)}{2R}$$

$$(j+1,k+1): \quad \frac{\pi(r^2_{i+1/2}-r^2_{j+1/2})(z_{i+1/2}-z_{k+1/2})}{2\pi r_i \Delta r \Delta z} \longrightarrow \frac{(R-j)(j+1+R)(Z-k)}{2R}$$

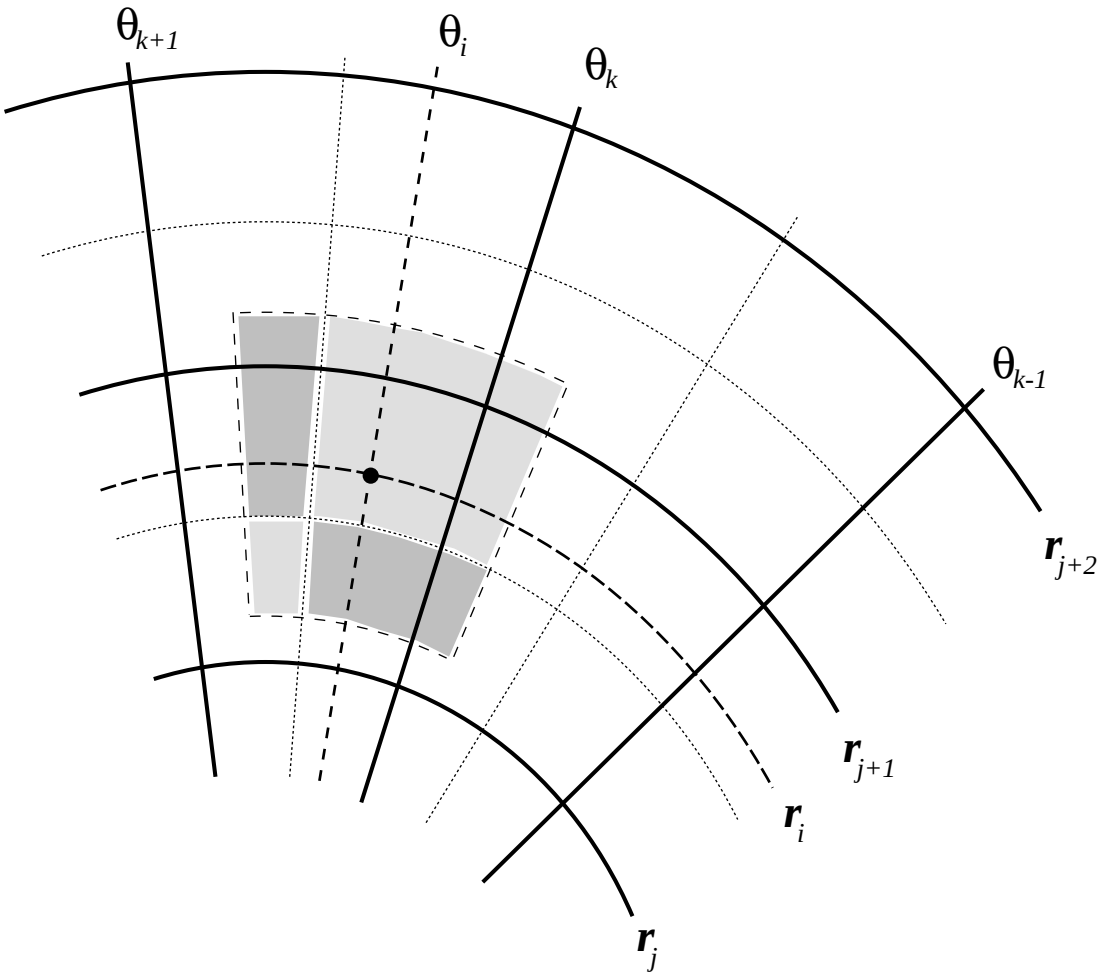
$$(j+1,k): \quad \frac{\pi(r^2_{i+1/2}-r^2_{j+1/2})(z_{k+1/2}-z_{i-1/2})}{2\pi r_i \Delta r \Delta z} \longrightarrow \frac{(R-j)(j+1+R)(k+1-Z)}{2R}$$

Particle-In-Cell (r^2-θ weighting)



Same as PIC $r^2 - z$ weightings...

Cloud-In-Cell (r^2-θ weighting)



Same as CIC $r^2 - z$ weightings...