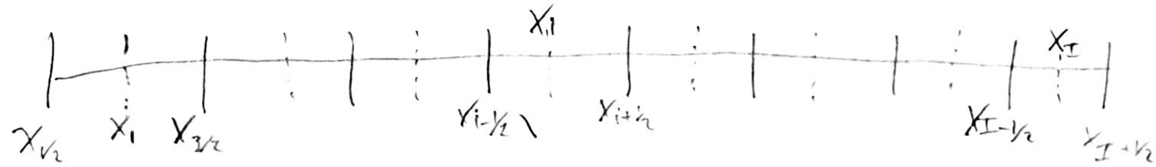
1) $2\psi(x,\mu) = \begin{cases} \sum_{\ell=0}^{N}(2\ell+1)\phi_\ell^{+}(x)P_\ell(2\mu-1) & \mu>0 \\ \sum_{\ell=0}^{N}(2\ell+1)\phi_\ell^{-}(x)P_\ell(2\mu+1) & \mu<0 \end{cases}$

DD $\quad \mu_n\left[\psi_{i+1/2,n} - \psi_{i+1/2,n}\right] + \sigma_i\Delta_i\psi_{in} = \Delta_i q_{in}$

$q_{in} = \sum_{\ell=1}^{L}(2\ell+1)\sigma_{s\ell i}P_\ell(\mu_n)\phi_{\ell i} + S_{in} \qquad \psi_{in} = \frac{1}{2}\left(\psi_{i+1/2,n} + \psi_{i-1/2,n}\right)$

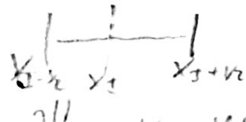
$\mu>0 \qquad \psi_{in} = \left(1+\frac{\sigma_i\Delta_i}{2|\mu_n|}\right)^{-1}\left(\psi_{i-1/2,n} + \frac{\Delta_i q_{in}}{2|\mu_n|}\right) \qquad \psi_{i+1/2,n} = 2\psi_{in} - \psi_{i-1/2,n}$

$\mu<0 \qquad \psi_{in} = \left(1+\frac{\sigma_i\Delta_i}{2|\mu_n|}\right)^{-1}\left(\psi_{i+\frac{1}{2},n} + \frac{\Delta_i q_{in}}{2|\mu_n|}\right) \qquad \psi_{i-1/2,n} = 2\psi_{in} - \psi_{i+1/2}$



a) For 1D slab as pictured above/defined above sweeping process is progressive following the direction of transport starting at left boundary. Calculate the first box and then sweep forward. Each box contributes to the previous

b) 1D start at right side with $\mu<0$ eqn and start with x_I $\psi_{I-1/2,n} = 2\psi_{In} - \psi$ and progress down until x_1. Build up progressively by sweeping downward for $\mu<0$

c) On the right edge  reflect the flux $\mu>0$ to $\mu<0$ first find $\psi_{I+1/2}$ normally in $\mu>0$ sweep then for $\mu>0$ $\psi_{I+1/2,n} = 2\psi_{In} - \psi_{I-1/2,n}$ equal $\mu<0$'s $\psi_{I-1/2,n} = 2\psi_{In} - \psi_{I+1/2}$

then iterate back normally for $\mu<0$ sweep

d) During the sweep only the flux moments ϕ_n need to be saved between iterations since $\psi_{i\ell}^{m}$ & q_{in}^{m} are built during the sweep

2) a) $\psi_a(x') = \psi_a(x) \exp\left[\frac{-\Sigma_t (x'-x)}{\mu_a}\right]$ $x' > x$ is soln of $\mu_a \frac{\partial \psi_a}{\partial x} + \Sigma_t \psi_a(x) = 0$

b) $\psi_{i+1/2,a} = e^{-2h} \psi_{i-1/2,a}$ where $h \equiv \frac{\Sigma_t \Delta}{2|\mu_a|}$ $\Delta = x_{i+1/2} - x_{i-1/2}$

$\psi_{i+1/2 a} = \exp(-2h) \psi_{i-1/2 a} =$

c) $a = 0$ $\frac{\mu_a}{\Delta_i}(\psi_{i+1/2} - \psi_{i-1/2}) + \Sigma_t \psi = 0$ for $\mu > 0$

$\psi_i = \frac{1}{2}(\psi_{i+1/2 a} + \psi_{i-1/2 a}) \rightarrow \frac{\mu_a}{\Delta_i}(\psi_{i+1/2 a} - \psi_{i-1/2}) + \frac{\Sigma_t}{2}(\psi_{i+1/2} + \psi_{i-1/2}) = 0$

let $h \equiv \frac{\Sigma_t \Delta_i}{2\mu_n}$ $(1+h)\psi_{i+1/2 a} = (1-h)\psi_{i-1/2 a}$

$\psi_{i+1/2} = \left(\frac{1-h}{1+h}\right)\psi_{i-1/2}$

d) expand part b in power series to get

from b) $\psi_{i+1/2 a} = e^{-2h} \psi_{i-1/2 a} \equiv 1 - 2h + \frac{4h^2}{2} + \text{etc}$

from c) $\psi_{i+1/2 a} = \left(\frac{1-h}{1+h}\right)\psi_{i-1/2 a} \equiv 1 - 2h + 2h^2 + \text{etc}$

these are the same after expansion

(e) To ensure positive flux $1 > h \equiv \frac{\Sigma_t \Delta}{2|\mu_n|}$
also in general mesh size decreases as S_N order increases
for const Σ_t & small const μ_n $\frac{2|\mu_n|}{\Sigma_t} > \Delta_i$

4) $\frac{\mu_a}{h_i}\left(\psi^g_{a,i+1/2} - \psi^g_{a,i-1/2}\right) + \Sigma^g_{t,i}\psi^g_{a,i} = 2\pi \sum_{a=1}^{N} w_a \sum_{g'=1}^{G} \Sigma_{s,i}^{gg'}(a' \to a)\psi^{g'}_{a',i} + \frac{\chi_g}{2}\sum_{g'=1}^{G} \nu_{g'} \Sigma^{g'}_{f,i}\phi^{g'}_i + \frac{1}{2}Q^g_i$

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grp 1 $\frac{\mu_a}{h_i}\left(\psi^1_{a,i+1/2} - \psi^1_{a,i-1/2}\right) + \Sigma^1_{t,i}\psi^1_{a,i} = \frac{\chi}{2}\sum_{g'=1}^{G} \nu_{g'} \Sigma_{f,i}\phi^{g'}_i + \frac{1}{2}Q^1_i$

grp 2 $\frac{\mu_a}{h_i}\left(\psi^2_{a,i+1/2} - \psi^2_{a,i-1/2}\right) + \Sigma^2_{t,i}\psi^2_{a,i} = \frac{\chi}{2}\sum_{g'=1}^{G} \nu_{g'} \Sigma_{f,i}\phi^{g'}_i + \frac{1}{2}Q^2_i$

grp 3 $\frac{\mu_a}{h_i}\left(\psi^3_{a,i+1/2} - \psi^3_{a,i-1/2}\right) + \Sigma^3_{t,i}\psi^3_{a,i} = 2\pi \sum_{a=1}^{N} w_a \sum_{g'=1}^{G} \Sigma_{s,i}^{3g'}(a' \to a)\psi^{g'}_{a',i} + \frac{1}{2}Q^3_i$

grp 4 $\frac{\mu_a}{h_i}\left(\psi^4_{a,i+1/2} - \psi^4_{a,i-1/2}\right) + \Sigma^4_{t,i}\psi^4_{a,i} = 2\pi \sum_{a=1}^{N} w_a \sum_{g'=1}^{G} \Sigma_{s,i}^{4g'}(a' \to a)\psi^{g'}_{a',i} + \frac{1}{2}Q^4_i$

grp 5 $\frac{\mu_a}{h_i}\left(\psi^5_{a,i+1/2} - \psi^5_{a,i-1/2}\right) + \Sigma^5_{t,i}\psi^5_{a,i} = 2\pi \sum_{a=1}^{N} w_a \sum_{g=1}^{G} \Sigma_{s,i}^{5g'}(a' \to a)\psi^{g'}_{a,i} + \frac{1}{2}Q^5_i$