MULTIGROUP SP3

A. $$\frac{d}{dx}\phi_{1,g} + \Sigma_{t,g}\phi_{0,g} = \sum_{g'=1}^{G} \Sigma_{0,g'g}\phi_{0,g'} + \frac{\chi_g}{k_{eff}} \sum_{g'=1}^{G} \nu\Sigma_{f,g'}\phi_{0,g'}$$

B. $$\frac{1}{3}\frac{d}{dx}\phi_{0,g} + \frac{2}{3}\frac{d}{dx}\phi_{2,g} + \Sigma_{t,g}\phi_{1,g} = \sum_{g'=1}^{G} \Sigma_{1,g'g}\phi_{1,g'}$$

C. $$\frac{2}{5}\frac{d}{dx}\phi_{1,g} + \frac{3}{5}\frac{d}{dx}\phi_{3,g} + \Sigma_{t,g}\phi_{2,g} = \sum_{g'=1}^{G} \Sigma_{2,g'g}\phi_{2,g'}$$

D. $$\frac{3}{7}\frac{d}{dx}\phi_{2,g} + \Sigma_{t,g}\phi_{3,g} = \sum_{g'=1}^{G} \Sigma_{3,g'g}\phi_{3,g'}$$

Following Beckert and Grundmann, 2007:

$$\Sigma_{n,gg'} = 0 \quad \wedge \quad g' \neq g \quad \wedge \quad n = 1, 2, 3$$

$$\Sigma_{r,n,g} = \Sigma_{t,g} - \Sigma_{n,gg} \qquad n = 0, 1, 2, 3$$

B) $$\phi_{1,g} = -\frac{1}{3\Sigma_{r,1,g}} \frac{d}{dx}\left[\phi_{0,g} + 2\phi_{2,g}\right]$$

D) $$\phi_{3,g} = -\frac{3}{7\Sigma_{r,3,g}} \frac{d}{dx}\phi_{2,g}$$

into A)

C)

~~A) $-\frac{1}{3\Sigma_{r,1,g}} \cdot \frac{d^2}{dx^2}$~~

$$\tilde{\phi}_0 = \phi_0 + 2\phi_2 \,, \quad \tilde{\phi}_2 = \phi_2$$

- $\frac{d}{dx}\phi_{1,g} + \Sigma_{r,0,g}\phi_{0,g} = \frac{\chi_g}{k_{eff}}\sum_{g'=1}^{G}\nu\Sigma_{fg'}\phi_{0g'} + \sum_{\substack{g'=1\\ g'\neq g}}^{G}\Sigma_{0,g'g}\phi_{0,g'}$

- $\cancel{\frac{3}{7}\frac{d}{dx}\phi_{2,g}}$

- $\frac{2}{5}\frac{d}{dx}\phi_{1,g} + \frac{3}{5}\frac{d}{dx}\phi_{3,g} + \Sigma_{r,2,g}\phi_{2,g} = 0$

$$\phi_{1,g} = -\frac{1}{3\Sigma_{r,1,g}}\frac{d}{dx}\left[\phi_{0,g} + 2\phi_{2,g}\right]$$

$$\phi_{3,g} = -\frac{3}{7\Sigma_{r,3,g}}\frac{d}{dx}\phi_{2,g}$$

A) $\frac{d}{dx}\left[\frac{-1}{3\Sigma_{r,1,g}}\left(\frac{d}{dx}\phi_{0,g} + 2\frac{d}{dx}\phi_{2,g}\right)\right] + \Sigma_{r,0,g}\phi_{0,g} =$

$= \frac{\chi_g}{k_{eff}}\sum_{g'=1}^{G}\nu\Sigma_{fg'}\phi_{0g'}$

B) $\frac{2}{5}\frac{d}{dx}\left[\frac{-1}{3\Sigma_{r,1,g}}\left(\frac{d}{dx}\phi_{0,g} + 2\frac{d}{dx}\phi_{2,g}\right)\right] +$

$+ \frac{3}{5}\frac{d}{dx}\left[\frac{-3}{7\Sigma_{r,3,g}}\frac{d}{dx}\phi_{2,g}\right] + \Sigma_{r,2,g}\phi_{2,g} = 0$

A) $\frac{-1}{3\Sigma_{r,1,g}}\left[\frac{d^2}{dx^2}\phi_{0,g} + 2\frac{d^2}{dx^2}\phi_{2,g}\right] +$

$+ \Sigma_{r,0,g}\phi_{0,g} = \underline{\frac{\chi_g}{k_{eff}}\sum_{g'=1}^{G}\nu\Sigma_{fg'}\phi_{0g'}} \quad \sum_{\substack{g'=1\\ g'\neq g}}^{G}\Sigma_{0,g'g}\phi_{0,g'}$

B) $\underset{\Sigma_{r,1,g}}{-\frac{2}{15}}\frac{d^2}{dx^2}\phi_{0,g} - \underset{\Sigma_{r,1,g}}{\frac{4}{15}}\frac{d^2}{dx^2}\phi_{2,g} - \frac{9}{35\Sigma_{r,3,g}}\frac{d^2}{dx^2}\phi_{2,g} + \Sigma_{r,2,g}\phi_{2,g} = 0$

CP3-2

A) $$-\frac{1}{3\Sigma_{r,1,g}}\left[\frac{d^2}{dx^2}\phi_{0,g} + 2\frac{d^2}{dx^2}\phi_{2,g}\right] + \Sigma_{r,0,g}\phi_{0,g} = \sum_{\substack{g'=1\\g'\neq g}}^{G}\Sigma_{0,g'g}\phi_{0,g'} + \frac{\chi_g}{k_{eff}}\sum_{g'=1}^{G}\nu\Sigma_{fg'}\phi_{0g'}$$

B) $$-\frac{2}{15\Sigma_{r,1,g}}\frac{d^2}{dx^2}\phi_{0,g} - \frac{4}{15\Sigma_{r,1,g}}\frac{d^2}{dx^2}\phi_{2,g} - \frac{9}{35\Sigma_{r,3,g}}\frac{d^2}{dx^2}\phi_{2,g} + \Sigma_{r,2g}\phi_{2,g} = 0$$

$$\tilde{\phi}_0 = \phi_0 + 2\phi_2, \quad \tilde{\phi}_2 = \phi_2$$

(A) $$-\frac{1}{3\Sigma_{r,1,g}}\frac{d^2}{dx^2}\tilde{\phi}_{0,g} + \Sigma_{r,0,g}\tilde{\phi}_{0,g} - 2\Sigma_{r,0,g}\tilde{\phi}_{2g} = \sum_{\substack{g'=1\\g'\neq g}}^{G}\Sigma_{0,g'g}\left(\tilde{\phi}_{0,g'} - 2\tilde{\phi}_{2,g}\right) + \frac{\chi_g}{k_{eff}}\sum_{g'=1}^{G}\nu\Sigma_{fg'}\left(\tilde{\phi}_{0,g'} - 2\tilde{\phi}_{2,g}\right)$$

(B) $$\underbrace{-\frac{2}{15\Sigma_{r,1,g}}}\frac{d^2}{dx^2}\tilde{\phi}_{0,g} - \frac{9}{35\Sigma_{r,3,g}}\frac{d^2}{dx^2}\tilde{\phi}_{2g} + \Sigma_{r,2,g}\tilde{\phi}_{2g} = 0$$

(A) $\rightarrow$ $$-\frac{1}{3\Sigma_{r,1,g}}\frac{d^2}{dx^2}\tilde{\phi}_{0,g} = -\Sigma_{r,0,g}\left(\tilde{\phi}_{0g} \cancel{\mp} 2\cancel{\Sigma_{r,0}}\tilde{\phi}_{2g}\right) + \sum_{\substack{g'=1\\g'\neq g}}^{G}\Sigma_{0,g'g}\left(\tilde{\phi}_{0,g'} - 2\tilde{\phi}_{2g}\right) + \frac{\chi_g}{k_{f}}\sum_{g'=1}^{G}\nu\Sigma_{fg'}\left(\tilde{\phi}_{0,g'} - 2\tilde{\phi}_{2g}\right)$$

$\downarrow \times \frac{2}{5}$ into (B)

$$-\frac{9}{35\Sigma_{r,3g}}\frac{d^2}{dx^2}\tilde{\phi}_{2,g} + \Sigma_{r,2g}\tilde{\phi}_{2g} - \frac{2}{5}\Sigma_{r,0g}\tilde{\phi}_{0,g} + \frac{4}{5}\Sigma_{r,0g}\tilde{\phi}_{2g} + \frac{2}{5}\sum_{\substack{g'=1\\g'\neq g}}\Sigma_{0,g'g}\left(\tilde{\phi}_{0,g'} - 2\tilde{\phi}_{2,g}\right) + \frac{2}{5}\frac{\chi_g}{k_f}\sum_{g'=1}^{G}\nu\Sigma_{fg'}\left(\tilde{\phi}_{0,g'} - 2\tilde{\phi}_{2g}\right) = 0$$

(B) $$-\frac{9}{35\Sigma_{r,3,g}}\frac{d^2}{dx^2}\tilde{\phi}_{2,g} + \left(\Sigma_{r,2g} + \frac{4}{5}\Sigma_{r,0,g}\right)\tilde{\phi}_{2g} - \frac{2}{5}\Sigma_{r,0g}\tilde{\phi}_{0g} = -\frac{2}{5}\sum_{\substack{g'=1\\g'\neq g}}^{G}\Sigma_{0g'g}\left(\tilde{\phi}_{0,g'} - 2\tilde{\phi}_{2,g}\right) - \frac{2}{5}\frac{\chi_g}{k}\ldots$$

$\hookrightarrow$ (A) & (B) equal (13)

CP3-3

$$\psi(x,\mu) = \frac{1}{4\pi}\phi_0 + \frac{3}{4\pi}\phi_1\mu + \frac{5}{4\pi}\phi_2 \overset{\frac{1}{2}(3\mu^2-1)}{} + \frac{7}{4\pi}\phi_3\ \tfrac{1}{2}(5\mu^3-3\mu)$$

$$\int \psi(x,\mu)\, P_1(\mu)\, d\mu = 0$$

$$\int \left[\phi_0 + 3\phi_1\mu + 5\phi_2 \tfrac{1}{2}(3\mu^2-1) + 7\phi_3 \tfrac{1}{2}\left(5\mu^3-3\mu\right)\right]\mu\, d\mu =$$

$$= \int \phi_0\mu + 3\phi_1\mu^2 + \frac{5}{2}\phi_2(3\mu^3-\mu) + \frac{7}{2}\phi_3(5\mu^4-3\mu^2)\, d\mu$$

$\hookrightarrow \begin{matrix} x=0 \\ \mu>0 \end{matrix} : \int_0^1 d\mu :\ \phi_0 \frac{1}{2} + 3\phi_1\frac{1}{3} + \frac{5}{2}\phi_2\left(\frac{3}{4}-\frac{1}{2}\right) + \frac{7}{2}\phi_3 \overset{=0}{\cancel{\left(\frac{5}{5}-\frac{3}{3}\right)}} = 0$

$$\cdot\ \frac{1}{2}\phi_0 + \phi_1 + \frac{5}{8}\phi_2 = 0$$

$\rightarrow \begin{matrix} x=a \\ \mu\le 0 \end{matrix} : \int_{-1}^{0} d\mu :\ -\frac{1}{2}\phi_0 + \phi_1 - \frac{5}{8}\phi_2 = 0$

$\hookrightarrow \cancel{\tfrac{1}{2}\phi_0 +}\ \frac{1}{2}\phi_{0g} + \underbrace{\frac{-1}{3\Sigma_{t,1,g}}\left[\frac{d}{dx}\left(\phi_{0g}+2\phi_{2g}\right)\right]}\ + \frac{5}{8}\phi_2$

$$\frac{1}{2}\tilde{\phi}_0 - \tilde{\phi}_2 + \cancel{2}\hat{n}\tilde{J}_0 + \frac{5}{8}\tilde{\phi}_2 = \frac{1}{2}\tilde{\phi}_0 + \hat{n}\tilde{J}_0 - \frac{3}{8}\tilde{\phi}_2 = 0 = \text{TO}(18)$$

$$\hookrightarrow \boxed{\frac{1}{4}\tilde{\phi}_0 + \frac{1}{2}\hat{n}\tilde{J}_0 - \frac{3}{8}\tilde{\phi}_2 = 0}$$

$$\int \psi(x,\mu)\, P_3(\mu)\, d\mu = 0$$

$$\int\left(\phi_0 \tfrac{1}{2}(5\mu^3-3\mu) + 3\phi_1\mu\tfrac{1}{2}(5\mu^3-3\mu) + 5\phi_2\tfrac{1}{2}(3\mu^2-1)\tfrac{1}{2}(5\mu^3-3\mu) + 7\phi_3\left[\tfrac{1}{2}(5\mu^3-3\mu)\right]^2\right)d\mu$$

$\Rightarrow \begin{matrix} x=0 \\ \mu>0 \end{matrix} :\ -\frac{1}{8}\phi_0 + 0 + \frac{5}{8}\phi_2 + \phi_3 = 0$

$\Rightarrow \begin{matrix} x=a \\ \mu<0 \end{matrix} :\ +\frac{1}{8}\phi_0 + 0 - \frac{5}{8}\phi_3 + \phi_3 = 0$

$$-\frac{1}{8}\phi_0 + \frac{5}{8}\phi_2 + \underbrace{\frac{-3}{7\Sigma}\frac{d}{dx}}\phi_2 = 0 \rightarrow -\frac{1}{8}\tilde{\phi}_0 + \frac{2}{8}\tilde{\phi}_2 + \frac{5}{8}\tilde{\phi}_2 + \hat{n}\tilde{J}_2\cdot\frac{5}{3} = 0$$

$$\frac{5}{3}\cancel{\phi}\ \hat{n}\, J_2 \qquad -\frac{1}{8}\tilde{\phi}_0 + \frac{7}{8}\tilde{\phi}_2 + \hat{n}\tilde{J}_2\frac{5}{3} = 0 = \text{TO}(18)$$

$$\tilde{J}_2 = -\frac{9}{35\Sigma_{3g}}\frac{d}{dx}\tilde{\phi}_2 \Rightarrow \frac{3}{5}\cdot\phi_3 \qquad \boxed{-\frac{3}{80}\tilde{\phi}_0 + \frac{21}{80}\tilde{\phi}_2 + \frac{1}{2}\hat{n}\tilde{J}_2 = 0}$$

VARIATIONAL FORM

CP3-4

(A)

$$\underbrace{-D_0 \frac{d^2}{dx^2}\tilde{\phi}_{0g}}_{\downarrow} + \Sigma_{r,0,g}\tilde{\phi}_{0g} - 2\Sigma_{r,0,g}\tilde{\phi}_{2g} - \sum_{\substack{g'=1\\ g'\neq g}}^{G} \Sigma_{0,g'g}(\tilde{\phi}_{0g'} - 2\tilde{\phi}_{2g'}) - \frac{\chi_g}{k_{eff}}\sum_{g'=1}^{G} \nu\Sigma_{fg'}(\tilde{\phi}_{0g'} - 2\tilde{\phi}_{2g'}) = 0$$

$$-D_0 \frac{d}{dx}\tilde{\phi}_{0g}\psi + D_0 \frac{d}{dx}\tilde{\phi}_{0g}\frac{d\psi}{dx} + \Sigma_{r0g}\tilde{\phi}_{0g} - \dots = 0$$

(B)

$$\underbrace{-D_{2g}\frac{d^2}{dx^2}\tilde{\phi}_{2g}}_{\downarrow} + \left(\Sigma_{r2g} + \frac{4}{5}\Sigma_{r0g}\right)\tilde{\phi}_{2g} - \frac{2}{5}\Sigma_{r0g}\tilde{\phi}_{0g} + \frac{2}{5}\left(\sum_{\substack{g'=1\\ g'\neq g}}^{G} \Sigma_{0,g'g}(\ ) + \frac{\chi_g}{k_{eff}}\sum_{g'=1}^{G}\nu\Sigma_{fg'}\dots\right) = 0$$

$$-D_{2g}\frac{d}{dx}\tilde{\phi}_{2g}\psi + D_{2g}\frac{d}{dx}\tilde{\phi}_{2g} + \dots = 0$$

BCs

(A) $\underbrace{-D_{0g}\frac{d}{dx}\tilde{\phi}_{0g}}_{=\hat{n}\tilde{J}_0} = -\frac{1}{2}\tilde{\phi}_0 + \frac{3}{4}\tilde{\phi}_2 \xRightarrow{\text{in Moltres}} \frac{1}{2}\tilde{\phi}_0 - \frac{3}{4}\tilde{\phi}_2$

(B) $-D_{2g}\frac{d}{dx}\tilde{\phi}_{2g} = \hat{n}\tilde{J}_2 = \frac{3}{40}\tilde{\phi}_0 - \frac{21}{40}\tilde{\phi}_2 \Rightarrow -\frac{3}{40}\tilde{\phi}_0 + \frac{21}{40}\tilde{\phi}_2$

1G, Fixed Source

CP3-5

(A)
$$-D_0 \frac{d^2}{dx^2}\tilde{\phi}_0 + \Sigma_{r,0}\tilde{\phi}_0 - 2\Sigma_{r,0}\tilde{\phi}_2 - Q_0 = 0$$

(B)
$$-D_2 \frac{d^2}{dx^2}\tilde{\phi}_{2g} + \left(\Sigma_{r,2} + \frac{4}{5}\Sigma_{r,0}\right)\tilde{\phi}_2 - \frac{2}{5}\Sigma_{r,0}\tilde{\phi}_0 + \frac{2}{5}Q_0 = 0$$

(A)
Group Diffusion → P3 Diff
~~Removal XS~~
Sigma R → P3 Sigma R
P3 Sigma Coupled →
Source

(B)
P3 Diff
P3 SigmaR
P3 Sigma Coupled
Source

$$D_0 = \frac{1}{3\Sigma_{r,1,g}} \rightarrow \Sigma_{r,1,g} = \Sigma_{t,g} - \Sigma_{1,gg}$$

$$\Sigma_{r,1} = \Sigma_t - \Sigma_{s1}$$

$$\Sigma_{r,0} = \Sigma_t - \Sigma_{s0} = \Sigma_{abs}(?)$$

$$D_2 = \frac{9}{35\Sigma_{r,3,g}} \rightarrow \Sigma_{r,3} = \Sigma_t - \Sigma_{s3}$$

$$\Sigma_{r,2} = \Sigma_t - \Sigma_{s2}$$

CP3-6

$\boxed{\text{1G, Criticality Source}}$

(A) $$-D_0 \frac{d^2}{dx^2}\tilde{\phi}_0 + \Sigma_{r0}\tilde{\phi}_0 - 2\Sigma_{r,0}\tilde{\phi}_2 - \frac{\chi^T}{k_{eff}}\nu\Sigma_f\left(\tilde{\phi}_0 - 2\tilde{\phi}_2\right) = 0$$

(B) $$-D_2 \frac{d^2}{dx^2}\tilde{\phi}_2 + \left(\Sigma_{r2} + \frac{4}{5}\Sigma_{r0}\right)\tilde{\phi}_2 - \frac{2}{5}\Sigma_{r,0}\tilde{\phi}_0 + \frac{2}{5}\frac{\chi^T}{k_{eff}}\nu\Sigma_f\left(\tilde{\phi}_0 - 2\tilde{\phi}_2\right) = 0$$

$2/5\,\tilde{\phi}_0 - 4/5\,\tilde{\phi}_2$

P3 Eigen fission kernel

$$\cancel{+\frac{2}{5}\frac{1}{k_{eff}}\nu\Sigma_f\left(\tilde{\phi}_2 - \tilde{\phi}_0\right)}$$

$$\cancel{\tilde{\phi}_0 - 2\tilde{\phi}_2}$$

$$-\frac{\chi^T}{k_{eff}}\nu\Sigma_f\left[\frac{4}{5}\tilde{\phi}_2 - \frac{2}{5}\tilde{\phi}_0\right]$$

MULTI GROUP, FIXED SOURCE

- $$-D_{0,g}\frac{d^2}{dx^2}\tilde{\phi}_{0g} + \Sigma_{r,0,g}\tilde{\phi}_{0g} - 2\Sigma_{r,0,g}\tilde{\phi}_{2g} - \sum_{\substack{g'=1\\ g'\neq g}}^{G}\Sigma_{0,g'g}\left(\tilde{\phi}_{0,g'} - 2\tilde{\phi}_{2,g'}\right) - \cancel{\frac{\chi_g}{k_{eff}}\sum_{g'=1}^{G}\nu\Sigma_{f g'}\left(\tilde{\phi}_{0g'} - 2\tilde{\phi}_{2g'}\right)} - Q_{0,g} = 0$$

- $$-D_{2,g}\frac{d^2}{dx^2}\tilde{\phi}_{2g} + \left(\Sigma_{r2g} + \frac{4}{5}\Sigma_{r0g}\right)\tilde{\phi}_{2g} - \frac{2}{5}\Sigma_{r0g}\tilde{\phi}_{0g} + \frac{2}{5}\left[\sum_{\substack{g'=1\\ g'\neq g}}^{G}\Sigma_{0,g'g}\left(\tilde{\phi}_{0g'} - 2\tilde{\phi}_{2g'}\right) + \cancel{\frac{\chi_g}{k_{eff}}\sum_{g'=1}\nu\Sigma_{fg'}\left(\tilde{\phi}_{0g'} - 2\tilde{\phi}_{2g'}\right)} + Q_{0g}\right] = 0$$

$Q_{0g} \Rightarrow Q_{0,1} = 1$

$G = 2 \qquad Q_{0,2} = 0$

Diffusion $\rightarrow$ $D_{01}\frac{d^2}{dx^2}\tilde{\phi}_{01}$ **Coupled** $-2\Sigma_{r,0,1}\tilde{\phi}_{21}$

$D_{02}\frac{d^2}{dx^2}\tilde{\phi}_{02}$ $\qquad -2\Sigma_{r,0,2}\tilde{\phi}_{22}$

Removal $\rightarrow$ $\Sigma_{r,0,1}\tilde{\phi}_{01}$ **Inscatter**

$\Sigma_{r,0,2}\tilde{\phi}_{02}$

$g=1$: $\cancel{-\Sigma_{s0,11}\left(\tilde{\phi}_{0,1} - 2\tilde{\phi}_{2,1}\right)} - \Sigma_{s0,21}\left(\tilde{\phi}_{0,2} - 2\tilde{\phi}_{2,2}\right)$

$g=2$: $-\Sigma_{s0,12}\left(\tilde{\phi}_{0,1} - 2\tilde{\phi}_{2,1}\right.$

$-\Sigma_{s0,22}\left(\phi_{?}\right.$

FIXED SOURCE 3G $\quad$ Eq A $\quad$ CP3-8

Diffusion:

$D_{01} \frac{d^2}{dx^2} \tilde{\phi}_{0,1}$

$D_{02} \frac{d^2}{dx^2} \tilde{\phi}_{0,2}$

$D_{03} \frac{d^2}{dx^2} \tilde{\phi}_{0,3}$

Removal:

$\Sigma_{r,0,g} \tilde{\phi}_{0,1}$

$\Sigma_{r,0,2} \tilde{\phi}_{0,2}$

$\Sigma_{r,0,3} \tilde{\phi}_{0,3}$

Coupled:

$-2\Sigma_{r,01} \tilde{\phi}_{2,1}$

$-2\Sigma_{r,02} \tilde{\phi}_{2,2}$

$-2\Sigma_{r,03} \tilde{\phi}_{2,3}$

Inscatter:

$$g=1 \quad \cancel{-\Sigma_{s0,11}\left(\tilde{\phi}_{0,1}-2\tilde{\phi}_{2,1}\right)} - \Sigma_{s0,21}\left(\tilde{\phi}_{0,2}-2\tilde{\phi}_{2,2}\right) - \Sigma_{s0,31}\left(\tilde{\phi}_{0,3}-2\tilde{\phi}_{2,3}\right)$$

$$g=2 \quad -\Sigma_{s0,12}\left(\tilde{\phi}_{0,1}-2\tilde{\phi}_{2,1}\right) \cancel{-\Sigma_{s0,22}\left(\tilde{\phi}_{0,2}-2\tilde{\phi}_{2,2}\right)} - \Sigma_{s0,32}\left(\tilde{\phi}_{0,3}-2\tilde{\phi}_{2,3}\right)$$

$$g=3 \quad -\Sigma_{s0,13}\left(\tilde{\phi}_{0,1}-2\tilde{\phi}_{2,1}\right) - \Sigma_{s0,23}\left(\tilde{\phi}_{0,2}-2\tilde{\phi}_{2,2}\right) \cancel{-\Sigma_{s0,33}\left(\tilde{\phi}_{0,3}-2\tilde{\phi}_{2,3}\right)}$$

Eq B

CP3-9

Diffusion

$-D_{2,g,0,1} \frac{d^2}{dx^2} \tilde{\phi}_{2,1}$

$-D_{2,2} \frac{d^2}{dx^2} \tilde{\phi}_{2,2}$

$-D_{2,3} \frac{d^2}{dx^2} \tilde{\phi}_{2,3}$

Removal

$+ \left(\Sigma_{r21} + \frac{4}{5} \Sigma_{r01}\right) \tilde{\phi}_{2,1}$

$+ \left(\Sigma_{r22} + \frac{4}{5} \Sigma_{r02}\right) \tilde{\phi}_{2,2}$

$+ \left(\Sigma_{r,2,3} + \frac{4}{5} \Sigma_{r,0,3}\right) \tilde{\phi}_{2,3}$

Couples :

$-\frac{2}{5} \Sigma_{r01} \tilde{\phi}_{01}$

$-\frac{2}{5} \Sigma_{r02} \tilde{\phi}_{02}$

$-\frac{2}{5} \Sigma_{r03} \tilde{\phi}_{03}$

Inscatter :

$g=1 \quad \frac{2}{5}\left[\cancel{\Sigma_{s0,11}\left(\tilde{\phi}_{0,1} - 2\tilde{\phi}_{2,1}\right)} + \Sigma_{s0,21}\left(\tilde{\phi}_{0,2} - 2\tilde{\phi}_{2,2}\right) - + \Sigma_{s0,31}\left(\tilde{\phi}_{0,3} - 2\tilde{\phi}_{2,3}\right)\right]$

$g=2 \quad \frac{2}{5}\left[\Sigma_{s0,12}\left(\tilde{\phi}_{0,1} - 2\tilde{\phi}_{2,1}\right) + \cancel{\Sigma_{s0,22}\left(\tilde{\phi}_{0,2} - 2\tilde{\phi}_{2,2}\right)} + \Sigma_{s0,32}\left(\tilde{\phi}_{0,3} - 2\tilde{\phi}_{2,3}\right)\right]$

$g=3 \quad \frac{2}{5}\left[\Sigma_{s0,13}\left(\tilde{\phi}_{0,1} - 2\tilde{\phi}_{2,1}\right) + \Sigma_{s0,22}\left(\tilde{\phi}_{0,2} - 2\tilde{\phi}_{2,2}\right) + \cancel{\Sigma_{s0,33}\left(\tilde{\phi}_{0,3} - 2\tilde{\phi}_{2,3}\right)}\right]$

Scanned with CamScanner

MULTIGROUP, CRITICALITY SOURCE

(A)

$$\underbrace{\text{FIXED SOURCE}}_{\text{w/o } -Q_{0,g}} + -\frac{\chi_g}{k_{eff}} \sum_{g'=1}^{G} \nu\Sigma_{fg'}\left(\tilde{\phi}_{0g'} - 2\tilde{\phi}_{2g'}\right) = 0$$

(B)

$$\text{FIXED SOURCE w/o } \frac{2}{5} + Q_{0,g} \quad + \frac{2}{5}\frac{\chi_g}{k_{eff}} \sum_{g'=1}^{G} \nu\Sigma_{fg'}\left(\tilde{\phi}_{0g'} - 2\tilde{\phi}_{2g'}\right) = 0$$

$\boxed{\text{Eq A}}$

$$-\frac{\chi_1}{k_{eff}} \cancel{\sum_{g'=1}^{G}} \left[\nu\Sigma_{f1}\left(\tilde{\phi}_{01} - 2\tilde{\phi}_{21}\right) + \nu\Sigma_{f2}\left(\tilde{\phi}_{02} - 2\tilde{\phi}_{22}\right) + \nu\Sigma_{f3}\left(\tilde{\phi}_{03} - 2\tilde{\phi}_{23}\right)\right]$$

$$-\frac{\chi_2}{k_{eff}} \left[\qquad \text{||} \qquad \right]$$

$$-\frac{\chi_3}{k_{eff}} \left[\qquad \text{||} \qquad \right]$$

$\boxed{\text{Eq B}}$

$$+\frac{2}{5}\frac{\chi_1}{k_{eff}} \left[\nu\Sigma_{f1}\left(\tilde{\phi}_{01} - 2\tilde{\phi}_{21}\right) + \nu\Sigma_{f2}\left(\tilde{\phi}_{02} - 2\tilde{\phi}_{22}\right) + \nu\Sigma_{f3}\left(\tilde{\phi}_{03} - 2\tilde{\phi}_{23}\right)\right]$$

$$+\frac{2}{5}\frac{\chi_2}{k_{eff}} \left[\nu\Sigma_{f1}\left(\tilde{\phi}_{01} - 2\tilde{\phi}_{21}\right) + \nu\Sigma_{f2}\left(\tilde{\phi}_{02} - 2\tilde{\phi}_{22}\right) + \nu\Sigma_{f3}\left(\tilde{\phi}_{03} - 2\tilde{\phi}_{23}\right)\right]$$

$$+\frac{2}{5}\frac{\chi_3}{k_{eff}} \left[\nu\Sigma_{f1}\left(\tilde{\phi}_{01} - 2\tilde{\phi}_{21}\right) + \nu\Sigma_{f2}\left(\tilde{\phi}_{02} - 2\tilde{\phi}_{22}\right) + \nu\Sigma_{f3}\left(\tilde{\phi}_{03} - 2\tilde{\phi}_{23}\right)\right]$$

$$D_{0,g} = \frac{1}{3\left(\Sigma_{t,g} - \Sigma_{s1,gg}\right)}$$ DIFFCOEF A

DIFFCOEF A

$$D_{2,g} = \frac{9}{35\left(\Sigma_{t,g} - \Sigma_{s3,gg}\right)}$$ DIFFCOEF B

REMXSA

$$\Sigma_{r,0,g} = \Sigma_{t,g} - \Sigma_{s0,gg}$$ REMXSA

$2 \Sigma_{r,0}$

~~REMXS B~~

COUPLEXS A

$$\Sigma_{r2,g} + \frac{4}{5}\Sigma_{r0,g} =$$ REMXS B

$$= \Sigma_{t,g} - \Sigma_{s2,gg} + \frac{4}{5}\left(\Sigma_{t,g} - \Sigma_{s0,gg}\right)$$

$$+\frac{2}{5}\Sigma_{r0,g} = \frac{2}{5}\left(\Sigma_{t,g} - \Sigma_{s0,gg}\right)$$ COUPLEXS B