

The thick solenoid matrix shown last time is symplectic and includes edge effects

$$R_{\text{sol}} = \begin{pmatrix} C^2 & \frac{SC}{K} & SC & \frac{S^2}{K} \\ -KSC & C^2 & -KS^2 & SC \\ -SC & -\frac{S^2}{K} & C^2 & \frac{SC}{K} \\ KS^2 & -SC & -KSC & C^2 \end{pmatrix} = \underbrace{\begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & -K & 0 \\ 0 & 0 & 1 & 0 \\ K & 0 & 0 & 1 \end{pmatrix}}_{\text{edge1}} \underbrace{\begin{pmatrix} 1 & \frac{SC}{K} & 0 & \frac{S^2}{K} \\ 0 & C^2 - S^2 & 0 & 2CS \\ 0 & -\frac{S^2}{K} & 1 & \frac{SC}{K} \\ 0 & -2CS & 0 & C^2 - S^2 \end{pmatrix}}_{\text{solenoid body}} \underbrace{\begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & K & 0 \\ 0 & 0 & 1 & 0 \\ -K & 0 & 0 & 1 \end{pmatrix}}_{\text{edge2}}$$

where $\underbrace{\begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & -K & 0 \\ 0 & 0 & 1 & 0 \\ K & 0 & 0 & 1 \end{pmatrix}}_{\text{edge1}} \underbrace{\begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & K & 0 \\ 0 & 0 & 1 & 0 \\ -K & 0 & 0 & 1 \end{pmatrix}}_{\text{edge2}} = \mathbf{1}$ (no problem with edges when using several pieces)

Simple thin version : $C \rightarrow 1, \sin KL \rightarrow KL, SC/K \rightarrow L$ (drift term), $S^2/K \rightarrow 0$

$$R_{\text{thinsol}} = \begin{pmatrix} 1 & 0 & KL & 0 \\ -K^2L & 1 & 0 & KL \\ -KL & 0 & 1 & 0 \\ 0 & -KL & K^2L & 1 \end{pmatrix}$$

verified, that inserting this between drifts of $L/2$ converges well with the numbers of slices n , and $L \rightarrow L/n$

(for $KL \ll 1$ as generally the case, in particular for LHC)