The transformation of a OCT is given as

$$\exp(: F_{\text{in}} :) \exp(: a\mathtt{L} :) \exp(: H_3/2 :) \exp(: b\mathtt{L} :) \\ \times \exp(: V_3 :) \exp(: a\mathtt{L} :) \exp(: H_3/2 :) \exp(: b\mathtt{L} :) \exp(: F_{\text{out}} :) , \tag{160}$$

where L and H_3 are the Hamiltonians of a drift of length L and a thin octupole kick with integrated strength K3:

$$H_3 = \frac{\mathtt{K3}}{4!} \Re (x - iy)^4 , \tag{161}$$

respectively. The coeffients are $a \equiv 1/2 - 1/\sqrt{12}$ and $b = 1/2 - a$. Terms $\exp(: F_{\text{in}} :)$ and $\exp(: F_{\text{out}} :)$ are transformations for entrance and exit nonlinear fringes. The term $\exp(: V_3 :)$ is a correction to adjust the third-order terms in L:

$$V_3 = \sum_{j=(x,y),k=(x,y)} -\frac{\beta}{2} H_{3,k}^2 + \gamma H_{3,j} H_{3,k} H_{3,j,k} , \tag{162}$$

where $,i$ represents the derivative by x or y. We have also introduced two coefficients $\beta \equiv 1/6 - 1/\sqrt{48}$ and $\gamma = 1/40 - 1/(24\sqrt{3})$.