$$1 - \frac{J_0}{2}(3\sin^2\beta - 1)$$

$$(1+x)^3 x = 4$$

$$(x^3 + 2x + 1)x = 4$$

$$x^4 + 2x^2 + x - 4 = 0$$

$$a+b+c = -2$$
$$bc + ca + ab = 1$$
$$abc = -4$$

$$\left(\frac{r}{a_e}\right)^3\left(\frac{r}{a_e} - 1\right)$$
$$\left(1 + \frac{\Delta r_{20}}{a_e}\right)\left(\frac{\Delta r_{20}}{a_e}\right)$$
$$\frac{\Delta r_{20}}{a_e} + \left(\frac{\Delta r_{20}}{a_e}\right)^2$$

$$② \Rightarrow \frac{r}{a_e} = 1 - \left(\frac{a_e}{r}\right)^2 J_0 \frac{3\sin^2\beta - 1}{2}$$

$$\left(\frac{r}{a_e}\right)^3 - \left(\frac{r}{a_e}\right)^2 = -J_0 \frac{3\sin^2\beta - 1}{2}$$

$r = a_e + \Delta r_{20}$ 대입하고 $a_e \gg \Delta r_{20}$

$$\text{좌변} \rightarrow \frac{\Delta r_{20}}{a_e} = -J_0 \frac{3\sin^2\beta - 1}{2}$$

$$\Delta r_{20} = -a_e J_0 \frac{3\sin^2\beta - 1}{2}$$