

$$R^2 - \frac{R^3}{ds_1} \rightarrow \frac{k}{R} \sin \varphi - \frac{ds_1 - R \frac{dR}{ds_1}}{R^2} (x \sin \varphi - y \cos \varphi) + k$$

$$K \frac{d\lambda}{ds_1} + \lambda \frac{dK}{ds_1} = \frac{dk}{ds_1} \cos \varphi - k \sin \varphi \frac{d\varphi}{ds_1} + \frac{R \left(\frac{d \sin \varphi - \frac{x}{R}}{ds_1} - y \frac{dR}{ds_1} \right)}{R^2} + \frac{k}{R} \sin \varphi - \frac{R \frac{x}{R} + y \frac{dR}{ds_1}}{R^2}$$

$$K^3 \frac{d\lambda}{ds_1} = \left[k^2 + \frac{u^2}{R^2} - \frac{2k}{R} (x \sin \varphi - y \cos \varphi) \right] \left[\frac{dk}{ds_1} \cos \varphi - k \sin \varphi \frac{d\varphi}{ds_1} + \frac{k}{R} \sin \varphi - \frac{R \frac{x}{R} + y \frac{dR}{ds_1}}{R^2} \right] -$$

$$- \left(k \cos \varphi + \frac{y}{R} \right) \left[k \frac{dk}{ds_1} - \frac{x}{R^2} - \frac{u^2}{R^3} \frac{dR}{ds_1} + \frac{k}{R} \sin \varphi - \frac{R \frac{dk}{ds_1} - k \frac{dR}{ds_1}}{R^2} (x \sin \varphi - y \cos \varphi) - \frac{k}{R} (x \cos \varphi + y \sin \varphi) \left(\frac{d\varphi}{ds_1} + \frac{1}{R} \right) \right]$$

$$K^3 \frac{d\lambda}{ds_1} = k \frac{dk}{ds_1} \cos \varphi - k^3 \sin \varphi \frac{d\varphi}{ds_1} + \frac{k^3}{R} \sin \varphi - \frac{k^2 R \frac{x}{R} + k^2 y \frac{dR}{ds_1}}{R^2} + \frac{u^2}{R^2} \frac{dk}{ds_1} \cos \varphi - \frac{k u^2}{R^2} \sin \varphi \frac{d\varphi}{ds_1} + \frac{k u^2}{R^3} \sin \varphi - \frac{u^2 R \frac{x}{R}}{R^2}$$

$$- \frac{2k}{R} \frac{dk}{ds_1} \cos \varphi (x \sin \varphi - y \cos \varphi) + \frac{2k^2}{R} \sin \varphi \frac{d\varphi}{ds_1} (x \sin \varphi - y \cos \varphi) - \frac{2k^2}{R^2} \sin \varphi (x \sin \varphi - y \cos \varphi) + \frac{2k}{R^3} \left(R \frac{x}{R} + y \frac{dR}{ds_1} \right)$$

$$+ \frac{k x}{R^2} \cos \varphi + \frac{k u^2}{R^3} \frac{dR}{ds_1} \cos \varphi - \frac{k^2}{R} \sin \varphi \cos \varphi + \frac{k \cos \varphi}{R^2} \left(R \frac{dk}{ds_1} - k \frac{dR}{ds_1} \right) (x \sin \varphi - y \cos \varphi) + \frac{k^2}{R} \cos \varphi$$

$$- \frac{k y}{R} \frac{dk}{ds_1} + \frac{x y}{R^3} + \frac{u^2 y}{R^4} \frac{dR}{ds_1} - \frac{k y}{R^2} \sin \varphi + \frac{y}{R^3} (x \sin \varphi - y \cos \varphi) \left(R \frac{dk}{ds_1} - k \frac{dR}{ds_1} \right) + \frac{k y}{R^2}$$