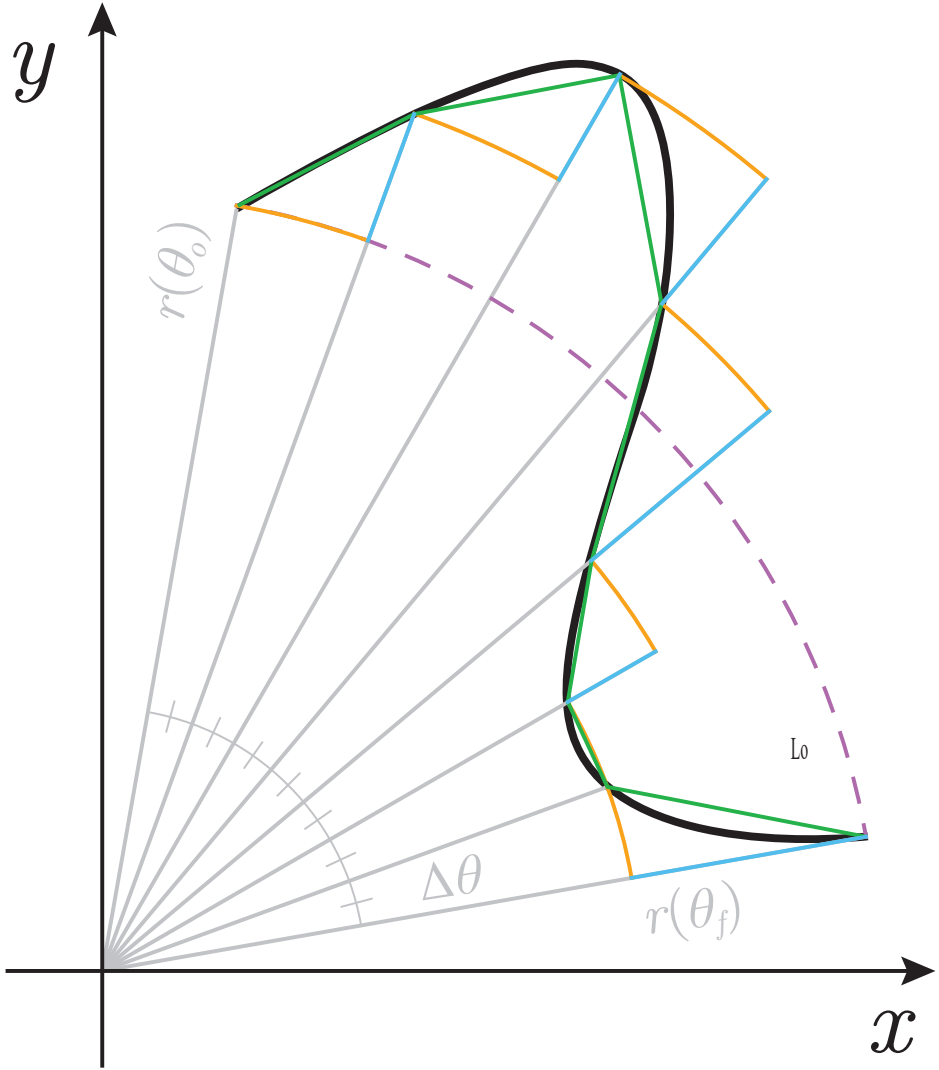

Polar Arc Length Equation

$$s = \lim_{\Delta\theta \to 0} \sum_{j=0}^{n-1} \sqrt{\left(r(\theta_j)\sin(\Delta\theta)\right)^2 + \left(r(\theta_{j+1}) - r(\theta_j)\right)^2}$$

$$= \lim_{\Delta\theta \to 0} \sum_{j=0}^{n-1} \sqrt{\left(r(\theta_j)\right)^2 + \left(\frac{r(\theta_{j+1}) - r(\theta_j)}{\Delta\theta}\right)^2}\,\Delta\theta$$

$$= \int_{\theta_o}^{\theta_f} \sqrt{\left(r(\theta)\right)^2 + \left(\frac{\partial r}{\partial \theta}\right)^2}\,d\theta$$

Previous MT Equation

$$s \approx \lim_{\Delta\theta \to 0} \sum_{j=0}^{n-1} r(\theta_j)\Delta\theta$$

Constant MA Equation

$$s \approx r(\theta_o)(\theta_f - \theta_o)$$