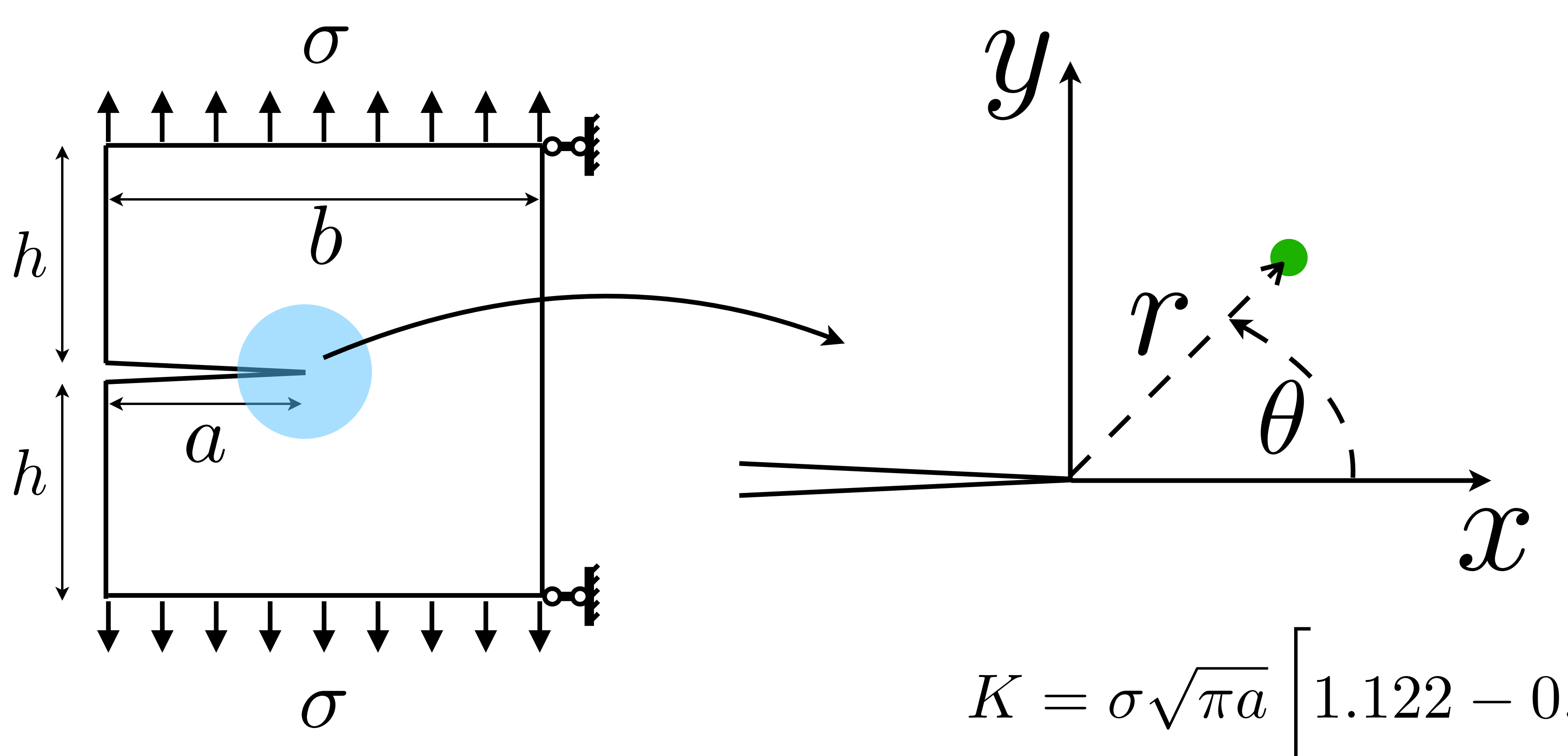

Near the vicinity of the crack tip we will have stress concentration, where the stresses at a given point in space are:

$$\sigma_{xx} = \frac{K}{\sqrt{2\pi r}}\cos\frac{\theta}{2}\left(1 - \sin\frac{\theta}{2}\sin\frac{3\theta}{2}\right)$$

$$\sigma_{yy} = \frac{K}{\sqrt{2\pi r}}\cos\frac{\theta}{2}\left(1 + \sin\frac{\theta}{2}\sin\frac{3\theta}{2}\right)$$

$$\sigma_{xy} = \frac{K}{\sqrt{2\pi r}}\cos\frac{\theta}{2}\sin\frac{\theta}{2}\cos\frac{3\theta}{2}$$

$$K = \sigma\sqrt{\pi a}\left[1.122 - 0.231\frac{a}{b} + 10.55\left(\frac{a}{b}\right)^2 - 21.71\left(\frac{a}{b}\right)^3 + 30.382\left(\frac{a}{b}\right)^4\right]$$

Some interesting work to do:

(1) Can we use FEM to reproduce the analytical solution of the stress distribution near the vicinity of the crack tip? In this regard, how much effect does the number of element near the crack tip have?

(2) Once we can use FEM to reproduce the analytical solution, can we explore different material composition scenarios (i.e., element made from different materials: Young’s modulus and Poisson’s ratio) and check how they change the stress distribution near the crack tip?