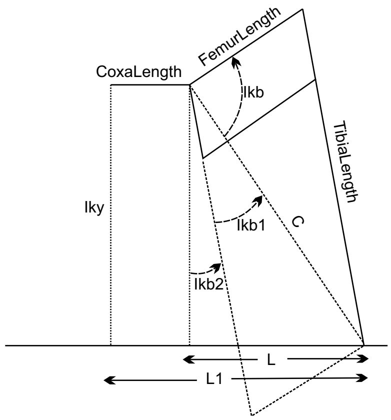
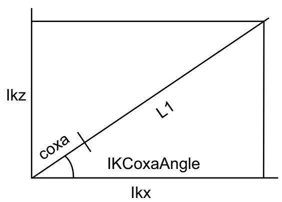
## Side View




## Overhead view




Ikx and ikz are determined by user input to the program with Ikz being the length of the leg stride movement and Ikx as the distance from the coxa pivot point to the leg tip (how far out is the leg tip from the body)
Iky is the height the robot is from the ground, also set by the user

A parallelogram is formed from the FemurLength and TibiaLength (see dotted lines). line C bisects the parallelogram to form 2 equal sized triangles. From there trigonometry determines the angles needed

1 Using overhead view, calculate length of leg from coxa pivot point to leg tip

$$L1 = \sqrt{(IKx^2 + Ikz^2)}$$

2 Get distance from leg tip to parallelogram pivot point

$$L = L1 - CoxaLength$$

3 Determine length of C

$$C = \sqrt{Iky^2 + L^2}$$

4 Use Law of Cosines to get angle IKb

$$Ikb = \cos^{-1}\left(\frac{FemurLength^2 + C^2 - TibiaLength^2}{2 * FemureLength * C}\right)$$

5 Get angle IKb2

$$Ikb2 = \tan^{-1}\left(\frac{L}{Iky}\right)$$

6 Get angle Ikb1 using Law of Cosines

$$Ikb1 = \cos^{-1}\left(\frac{TibiaLength^2 + C^2 - FemurLength^2}{2 * TibiaLength * C}\right)$$

7 Get the 3 output angles

$$IkFemurAngle = IKb + IKb2$$

$$IkTibiaAngle = IKb2 - IKb1$$

$$IkCoxaAngle = \tan^{-1}\left(\frac{Ikz}{Ikx}\right)$$