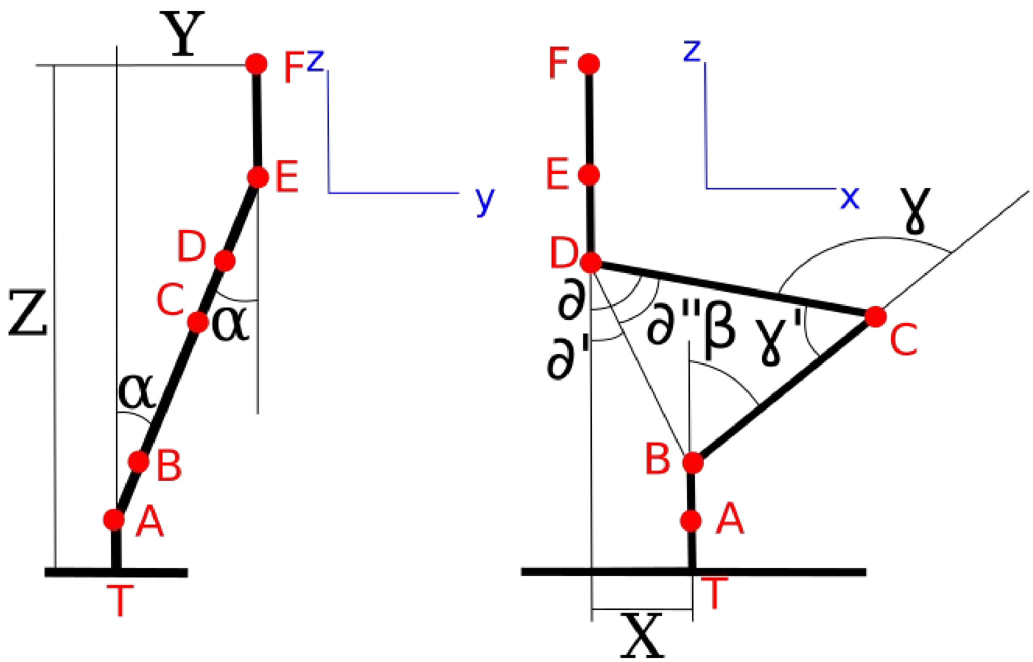
INVERSE KINEMATICS:

That’s a Tamtam leg schema in the ***zy*** and ***zx*** planes :



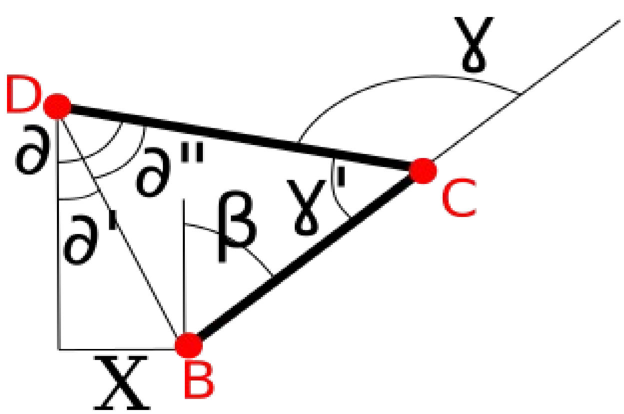
Where **T** is refered from **F** and has the components **(X , Y, Z)**, so first we may compute the ***α*** angle:

$$\alpha = tg^{-1}\left(\frac{Y}{Z - \overline{TA} - \overline{EF}}\right)$$

Now we can compute the distance between **B** and **D** using pitagoras:

$$\overline{BD} = \sqrt{X^2 + (Y - \overline{AB}\sin\alpha - \overline{DE}\sin\alpha)^2 + (Z - \overline{AB}\cos\alpha - \overline{DE}\cos\alpha - \overline{TA} - \overline{EF})^2}$$

So now we have a triangle which we know all the dimensions but the angles:



aplying the law of cosinus we may obtain ***γ’*** angle:

$$\gamma' = \cos^{-1}\left(\frac{\overline{BC}^2 + \overline{CD}^2 - \overline{BD}^2}{2\,\overline{BC}\,\overline{CD}}\right)$$

and since ***γ* = 180 -*γ*’** :

$$\gamma = 180 - \cos^{-1}\left(\frac{\overline{BC}^2 + \overline{CD}^2 - \overline{BD}^2}{2\,\overline{BC}\,\overline{CD}}\right)$$

we also may compute ***ð’***: $\delta' = \sin^{-1}\left(\frac{X}{\overline{BD}}\right)$ and ***ð”***: $\delta'' = \cos^{-1}\left(\frac{\overline{CD}^2 + \overline{BD}^2 - \overline{BC}^2}{2\,\overline{CD}\,\overline{BD}}\right)$

And since ð = ð' + ð ":

$$\delta = \sin^{-1}\left(\frac{X}{\overline{BD}}\right) + \cos^{-1}\left(\frac{\overline{CD}^2 + \overline{BD}^2 - \overline{BC}^2}{2\,\overline{CD}\,\overline{BD}}\right)$$

And to finish, using the fact that adding all the intern angles of a triangle you get 180 degrees:

$$\beta = 180 - \delta - (180 - \gamma) = \gamma - \delta$$

Now we need to add the rotation component for the leg, I'll use a rotation matrix in Z axis:

so we obtain: x,y,z,ε → X,Y,Z:

to do so:

$$X = x \cos \varepsilon + y \sin \varepsilon$$
$$Y = y \cos \varepsilon - x \sin \varepsilon$$
$$Z = z$$

where ε is the **F** rotation angle.

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