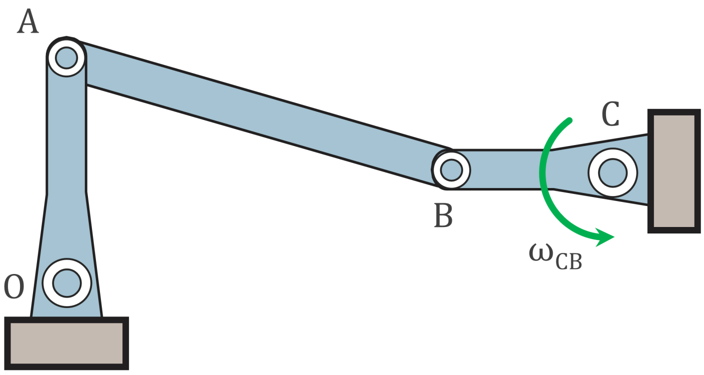
Acceleration of Linkage



Crank CB has a constant angular velocity in the position shown during a short interval of its motion. To determine the angular acceleration of links AB and OA for this position two relations for the acceleration in point A can be written and set equal to each other. Select the *two* expressions for $\mathbf{a}_{\mathrm{A}}$ that must set equal to each other to solve for α_{AB} and α_{OA}.

Using known expressions (for rigid bodies):

$$\mathbf{a}_{\mathrm{A}} = \mathbf{a}_{\mathrm{O}} + \mathbf{a}_{\mathrm{A/O},n} + \mathbf{a}_{\mathrm{A/O},t} \tag{1}$$

$$\mathbf{a}_{\mathrm{A/O},n} = \boldsymbol{\omega}_{\mathrm{OA}} \times (\boldsymbol{\omega}_{OA} \times \mathbf{r}_{\mathrm{A/O}}) \tag{2}$$

$$\mathbf{a}_{\mathrm{A/O},t} = \boldsymbol{\alpha}_{\mathrm{OA}} \times \mathbf{r}_{\mathrm{A/O}} \tag{3}$$

Solution:

Inserting Equations (2) and (3) in Equation (1), together with the fact that point O is fixed to the base, hence $\mathbf{a}_{\mathrm{O}} = \mathbf{0}$ gives:

$$\mathbf{a}_{\mathrm{A}} = \boldsymbol{\omega}_{\mathrm{OA}} \times (\boldsymbol{\omega}_{\mathrm{OA}} \times \mathbf{r}_{\mathrm{A/O}}) + \boldsymbol{\alpha}_{\mathrm{OA}} \times \mathbf{r}_{\mathrm{A/O}} \tag{4}$$

We do the same for the second relation, only we start from the other side, so side B. Here $\mathbf{a}_{\mathrm{B}} \neq \mathbf{0}$ m/s, this results in:

$$\mathbf{a}_{\mathrm{A}} = \mathbf{a}_{\mathrm{B}} + \boldsymbol{\omega}_{\mathrm{BA}} \times (\boldsymbol{\omega}_{\mathrm{BA}} \times \mathbf{r}_{\mathrm{A/B}}) + \boldsymbol{\alpha}_{\mathrm{BA}} \times \mathbf{r}_{\mathrm{A/B}} \tag{5}$$

These two equations can be set equal to each other to solve for α_{OA} and α_{BA}.