

## 2. Kinematic Analysis

### Inverted Slider-Crank

$$\overrightarrow{A_{0_1}A_{0_2}} + \overrightarrow{A_{0_2}A_2} = \overrightarrow{A_{0_1}B_{0_1}} + \overrightarrow{B_{0_1}B_{0_4}} + \overrightarrow{B_{0_4}Q_4} + \overrightarrow{Q_4A_3}$$
$$+ a_2 e^{i\theta_{12}} = a_1 + 0 + a_4 e^{i\theta_{14}} + s_{43} e^{i(\theta_{14} + \beta_4)}$$

The diagram illustrates the kinematic analysis of an inverted slider-crank mechanism. It shows the mechanism in two configurations: one where the slider A<sub>2</sub> is at zero displacement (labeled 'Zero Vectors') and another where it has moved to position Q<sub>4</sub> (labeled 'Body Vectors'). The vectors involved in the analysis are:

- Position vectors:  $\overrightarrow{A_{0_1}A_{0_2}}$ ,  $\overrightarrow{A_{0_2}A_2}$ ,  $\overrightarrow{A_{0_1}B_{0_1}}$ ,  $\overrightarrow{B_{0_1}B_{0_4}}$ ,  $\overrightarrow{B_{0_4}Q_4}$ ,  $\overrightarrow{Q_4A_3}$ .
- Motion vectors:  $a_2 e^{i\theta_{12}}$ ,  $a_1$ ,  $0$ ,  $a_4 e^{i\theta_{14}}$ ,  $s_{43} e^{i(\theta_{14} + \beta_4)}$ .
- Joint variables:  $\theta_{12}$ ,  $\theta_{14}$ ,  $\beta_4$ ,  $a_1$ ,  $a_2$ ,  $a_4$ ,  $s_{43}$ .

A translational joint variable vector  $(s_{4/3})$  is shown originating from joint A and pointing towards joint Q<sub>4</sub>.