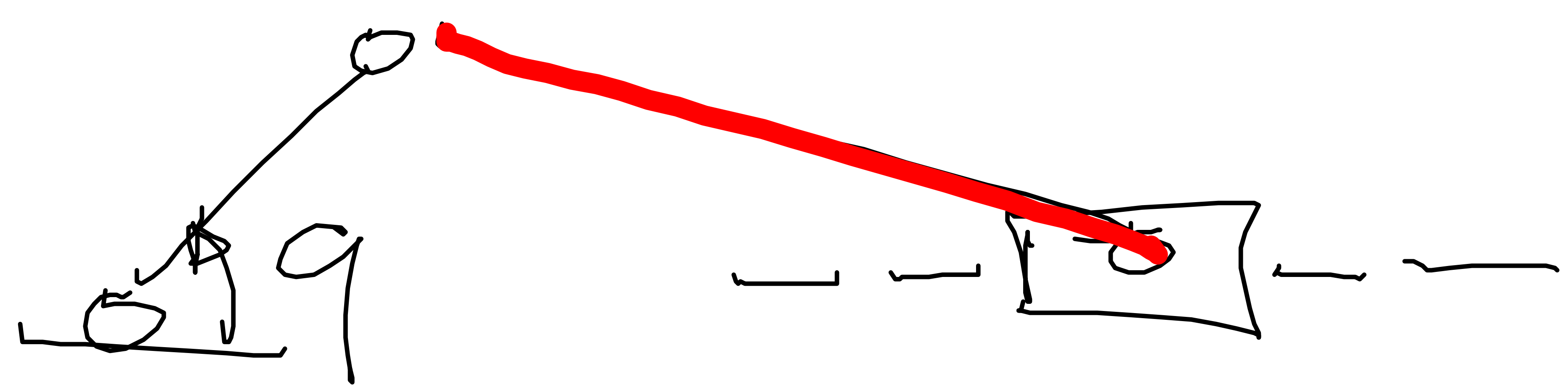
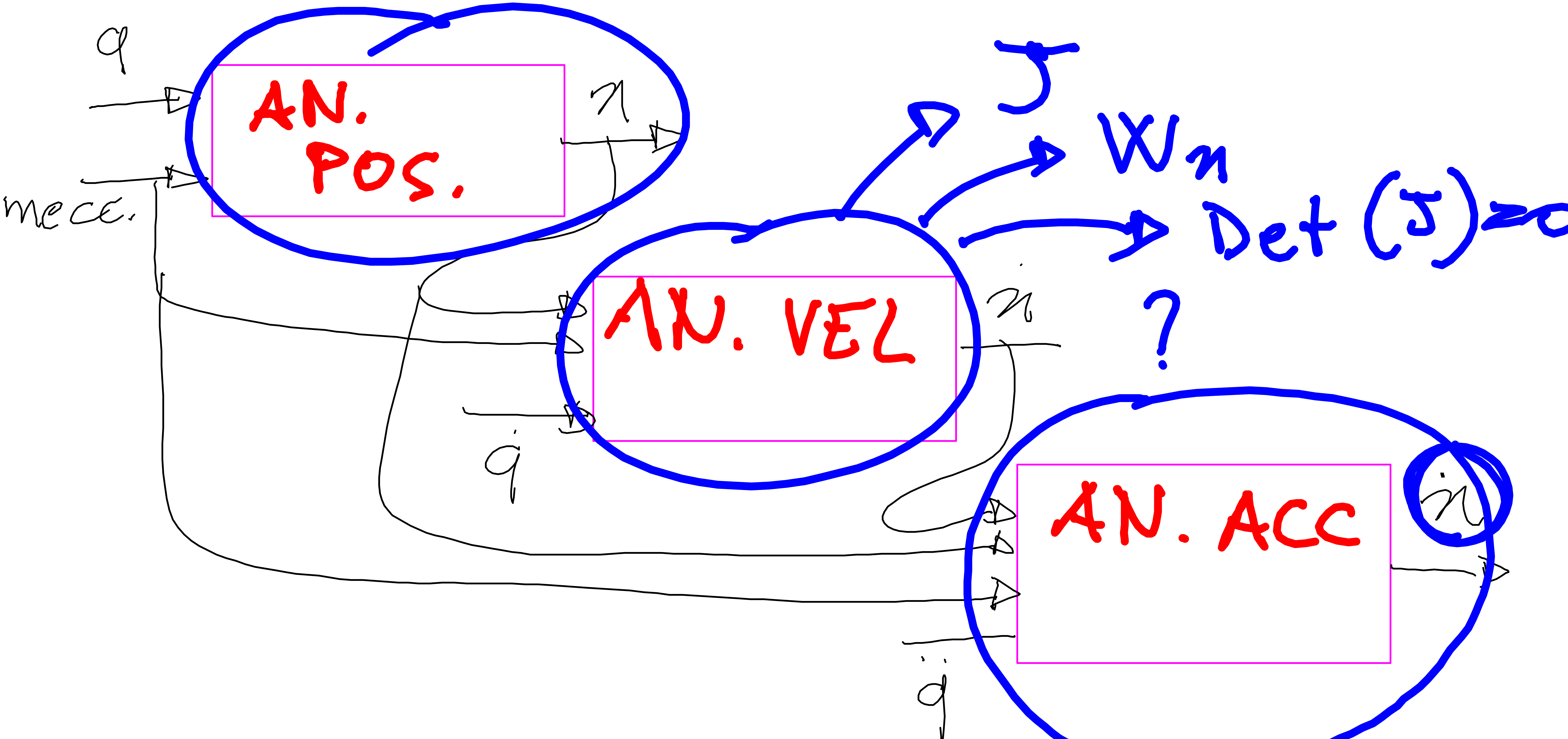


AN. ACCELERAZIONE



$$J\dot{x} + A\dot{q} = 0$$

$$\dot{J}\dot{x} + J\ddot{x} + \dot{A}\dot{q} + A\ddot{q} = 0$$

$$\Leftrightarrow \boxed{\ddot{x} = -\underline{J}^{-1}\left(\underline{A}\,\underline{\ddot{q}} + \underline{\dot{A}}\,\underline{\dot{q}} + \underline{\dot{J}}\,\underline{\dot{x}}\right)}$$

$$\ddot{x} = \cancel{B}\,\ddot{q}$$

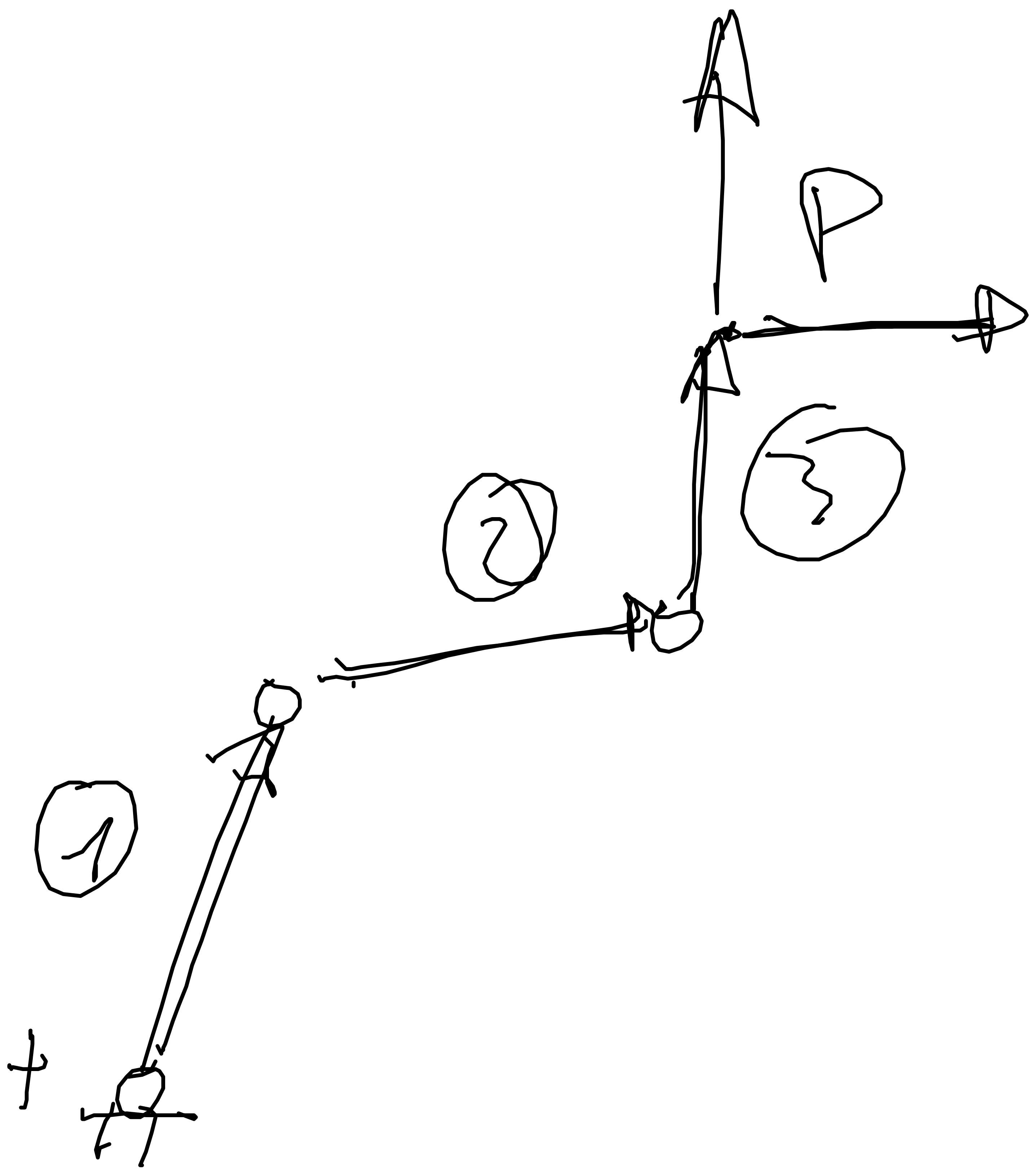
$$\ddot{x}$$

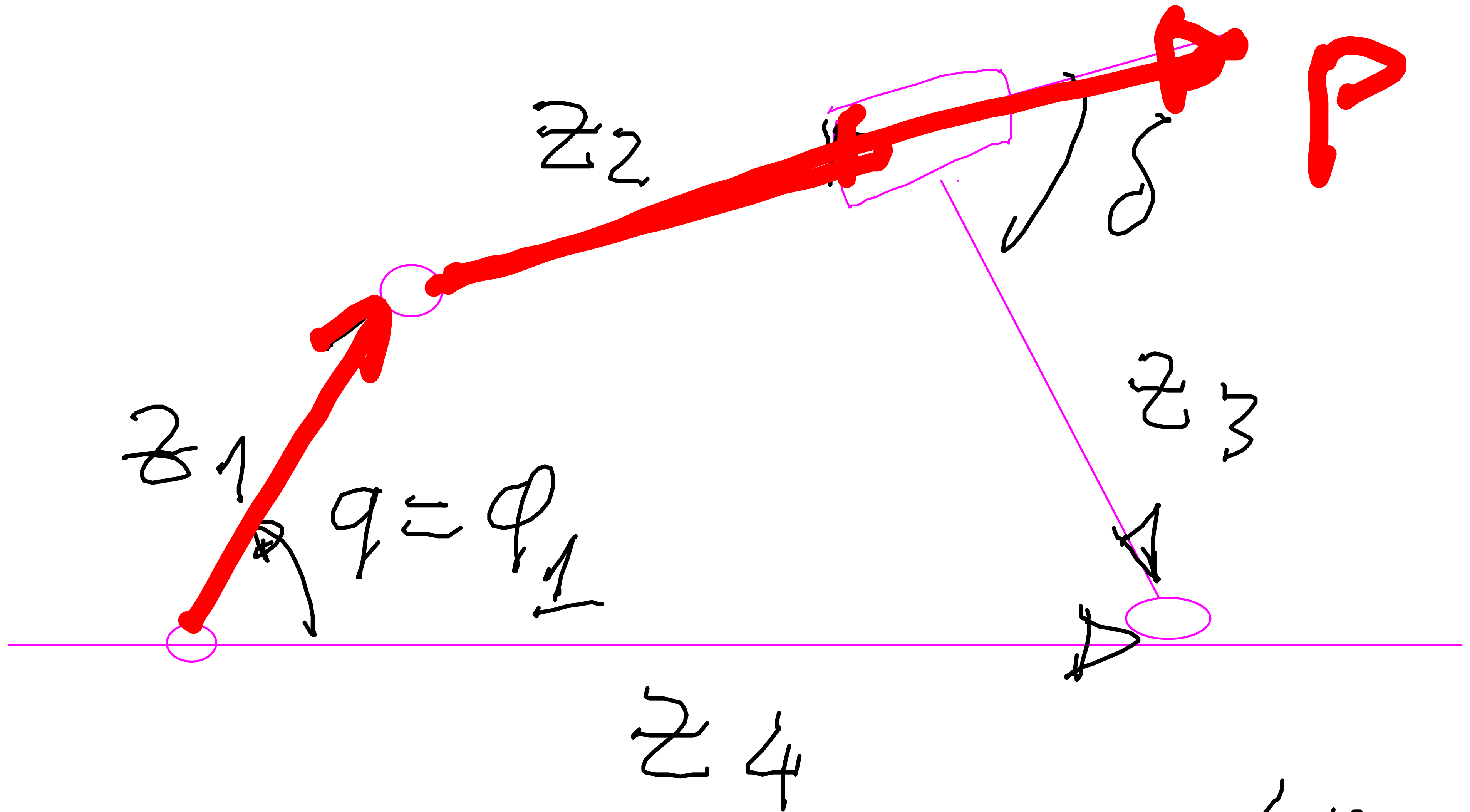
$$\sum \dot{z}_i = 0$$

$$\sum \ddot{z}_i = 0 \longrightarrow \ddot{n}$$

$$\dot{p} = \sum_i \begin{bmatrix} c\varphi_i & -z_i s\varphi_i \\ s\varphi_i & z_i c\varphi_i \end{bmatrix} \begin{pmatrix} \dot{z}_i \\ \dot{\varphi}_i \end{pmatrix}$$

$$\ddot{p} = \sum_i \begin{bmatrix} -s\varphi_i \dot{\varphi}_i & -\dot{z}_i s\varphi_i - z_i c\varphi_i \dot{\varphi}_i \\ c\varphi_i \dot{\varphi}_i & +\dot{z}_i c\varphi_i - z_i s\varphi_i \dot{\varphi}_i \end{bmatrix} \begin{pmatrix} \dot{z}_i \\ \dot{\varphi}_i \end{pmatrix} + \begin{bmatrix} c\varphi_i & -z_i s\varphi_i \\ s\varphi_i & z_i c\varphi_i \end{bmatrix} \boxed{\begin{pmatrix} \ddot{z}_i \\ \ddot{\varphi}_i \end{pmatrix}}$$





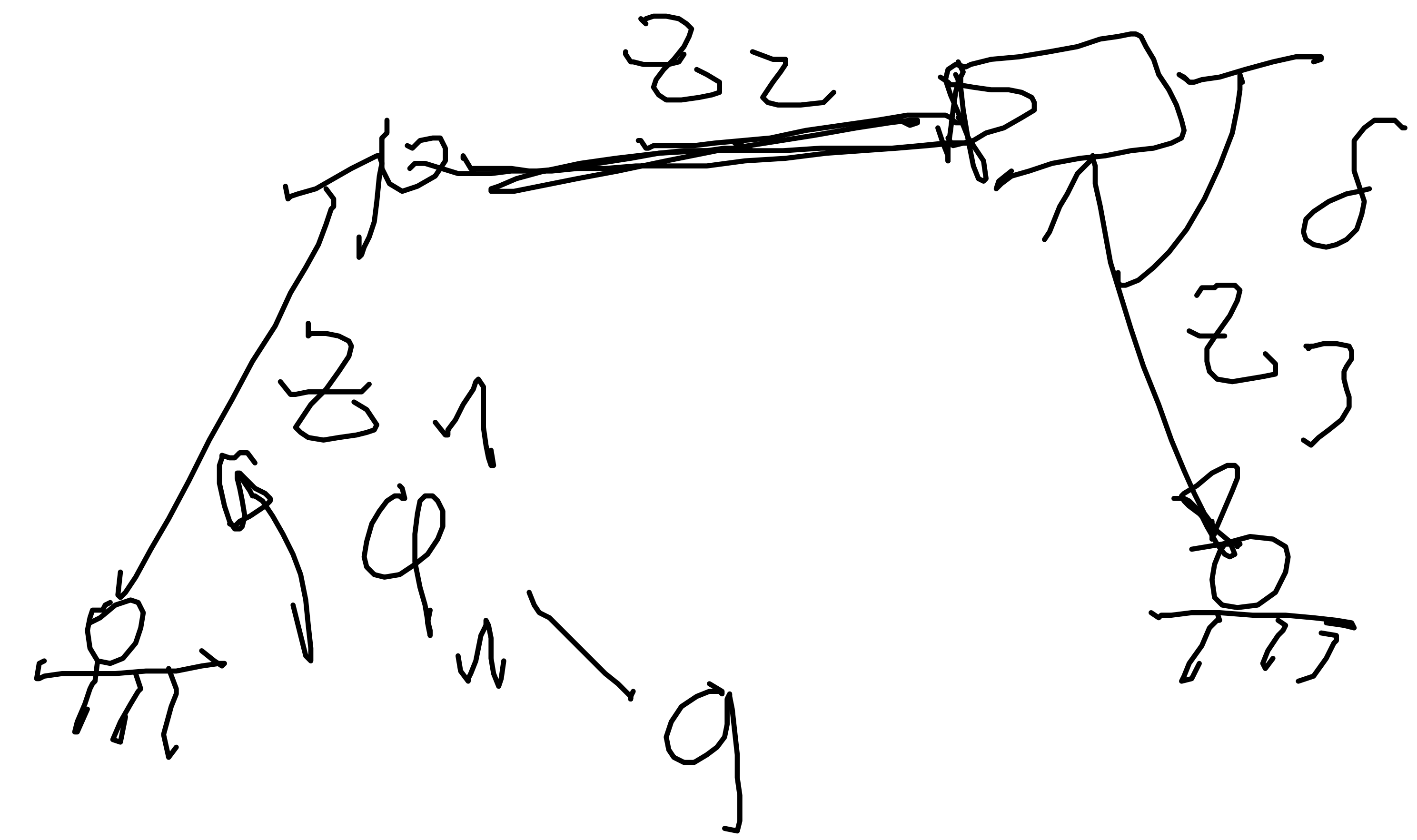
$$\dot{A} = \begin{bmatrix} -z_1 c\varphi_1 \\ -z_1 s\varphi_1 \end{bmatrix} \dot{\varphi}_1$$

$$A = \begin{bmatrix} -z_1 s\varphi_1 \\ z_1 c\varphi_1 \end{bmatrix}$$

$$J = \begin{bmatrix} -z_2 s\varphi_2 - z_3 s(\varphi_2 - \delta) & c\varphi_2 \\ z_2 c\varphi_2 + z_3 c(\varphi_2 - \delta) & s\varphi_2 \end{bmatrix}$$

$$\dot{J} = \begin{bmatrix} -\dot{z}_2 s\varphi_2 - z_2 c\varphi_2 \dot{\varphi}_2 - z_3 c(\varphi_2 - \delta)\dot{\varphi}_2 & -s\varphi_2 \dot{\varphi}_2 \\ \dot{z}_2 c\varphi_2 - z_2 s\varphi_2 \dot{\varphi}_2 - z_3 s(\varphi_2 - \delta)\dot{\varphi}_2 & c\varphi_2 \dot{\varphi}_2 \end{bmatrix}$$

$$J = J(q)$$



$$J \left\{ \begin{matrix} \dot\varphi_2 \\ \dot z_2 \end{matrix} \right] + A \dot\varphi_1 = 0$$

$$J = J\big(z_2(q), \varphi_2(q)\big)$$

$$\boxed{\begin{bmatrix} -z_2 s\varphi_2 - z_3 s(\varphi_2 - \delta) & c\varphi_2 \\ z_2 c\varphi_2 + z_3 c(\varphi_2 - \delta) & s\varphi_2 \end{bmatrix}}$$