5. Taking the projection equation

$$x = \frac{X}{Z}, \quad y = \frac{Y}{Z}$$

Differenting wrt time

$$\dot{p} = \frac{\dot{P}}{Z} - \frac{\dot{Z}}{Z} p$$

For translational flow:- $\dot{p}_{trans} = \frac{V_z}{Z} \begin{bmatrix} x - \frac{V_x}{V_z} \\ y - \frac{V_y}{V_z} \end{bmatrix}$

$$\frac{V_z}{Z} = \frac{\| \dot{p}_{trans} \|}{\| p - \vec{FOE} \|}$$

So for depth $\frac{Z}{V_z} = \frac{\| \dot{p}_{trans} \|}{\| p - \vec{FOE} \|}$

$$Z = V_z \frac{\| \dot{p}_{trans} \|}{\| p - \vec{FOE} \|}$$

To calculate V I used $\dot{p}_{trans} (p \times V) = 0$

And with coplanarity condition $V^T (p \times \dot{p}_{trans}) = 0$

For n points we obtain a homogeneous system

$$\underbrace{\begin{pmatrix} (p_1 \times \dot{p}_1)^T \\ (p_2 \times \dot{p}_2)^T \\ \cdots \\ (p_n \times \dot{p}_n)^T \end{pmatrix}}_{A} V = 0$$

So, I do SVD on A to obtain V in the nullspace of A.