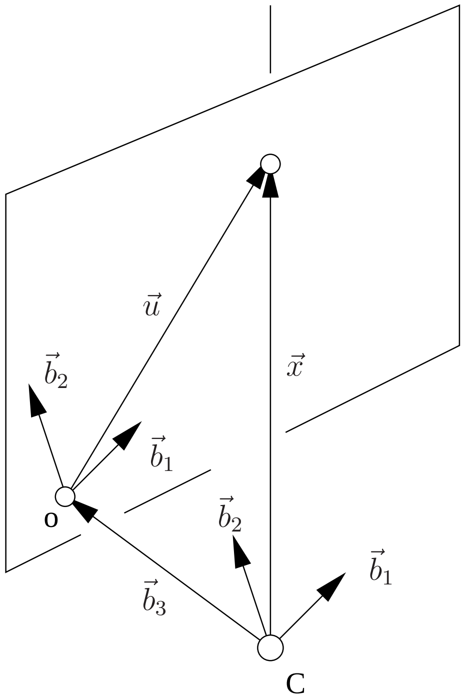
GVG Lab-04 CZ

1. Vytvořte companion matrix M_x pro polynom $2x^3 - 6x^2 + 11x - 6$.

2. Najděte nějakou bázi $\alpha = (\vec{a}_1, \vec{a}_2, \vec{a}_3)$, vůči které má vektor $\vec{x}$ souřadnice $[2, 3, 2]^\top$ dle následujícího obrázku, když vektor $\vec{u} = 2\,\vec{b}_1 + 3\,\vec{b}_2$. Napište souřadnice vektorů α v bázi $\beta = (\vec{b}_1, \vec{b}_2, \vec{b}_3)$.



3. Mějte kameru s projekční maticí

$$\mathtt{P} = \begin{bmatrix} 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 \end{bmatrix}$$

   Napište kosinus úhlu, který svírají paprsky procházející body v obraze $[0, 0]^\top$ a $[1, 1]^\top$?

4. Vypočtěte rotaci $\mathtt{R}$ a střed promítání $\vec{C}_\delta$ kamery s kalibrační maticí kamery

$$\mathtt{K} = \begin{bmatrix} 1 & 0 & 2 \\ 0 & 1 & 3 \\ 0 & 0 & 1 \end{bmatrix}$$

   když znáte, že 3 body v prostoru

$$\vec{X}_{1\delta} = \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}, \quad \vec{X}_{2\delta} = \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix}, \quad \vec{X}_{3\delta} = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$$

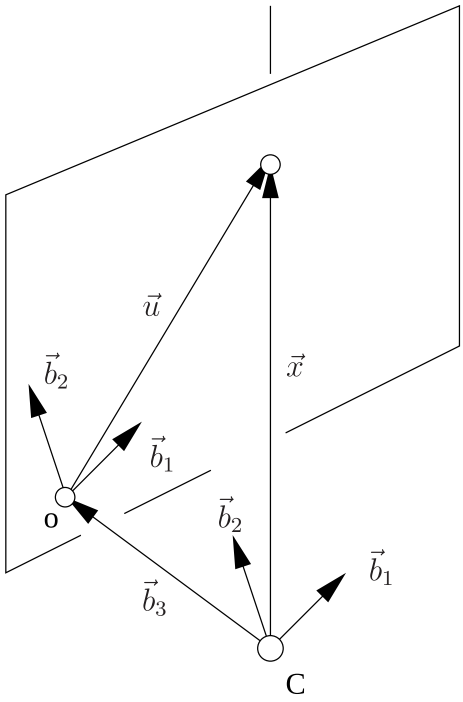
   se promítají do obrazu do bodů

$$\vec{u}_{1\alpha} = \begin{bmatrix} 3 \\ 3 \end{bmatrix}, \quad \vec{u}_{2\alpha} = \begin{bmatrix} 1 \\ 4 \end{bmatrix}, \quad \vec{u}_{3\alpha} = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$$

GVG Lab-04 EN

1. Create companion matrix M_x for polynomial $2x^3 - 6x^2 + 11x - 6$.

2. Find a basis $\alpha = (\vec{a}_1, \vec{a}_2, \vec{a}_3)$ such that vector $\vec{x}$, which is obtained as $\vec{u} = 2\,\vec{b}_1 + 3\,\vec{b}_2$ as shown in the following figure, would have coordinates in α equal to $[2, 3, 2]^\top$. Write down the coordinates of the vectors of α in basis $\beta = (\vec{b}_1, \vec{b}_2, \vec{b}_3)$.



3. Let us have a camera with projection matrix

$$\mathtt{P} = \begin{bmatrix} 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 \end{bmatrix}$$

   write the cosine of the angle between rays passing through image points $[0, 0]^\top$ a $[1, 1]^\top$?

4. Compute the calibrated camera pose $(\mathtt{R}, \vec{C}_\delta)$ of the camera with camera calibration matrix

$$\mathtt{K} = \begin{bmatrix} 1 & 0 & 2 \\ 0 & 1 & 3 \\ 0 & 0 & 1 \end{bmatrix}$$

   if you know that 3 world points

$$\vec{X}_{1\delta} = \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}, \quad \vec{X}_{2\delta} = \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix}, \quad \vec{X}_{3\delta} = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$$

   project to the following image points

$$\vec{u}_{1\alpha} = \begin{bmatrix} 3 \\ 3 \end{bmatrix}, \quad \vec{u}_{2\alpha} = \begin{bmatrix} 1 \\ 4 \end{bmatrix}, \quad \vec{u}_{3\alpha} = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$$

   respectively.