

Aufgabe 02.3

$$(a) \vec{r}(t) = \begin{pmatrix} x(t) \\ y(t) \\ z(t) \end{pmatrix} = \begin{pmatrix} b_0 + b_1 t + b_2 t^2 \\ c_1 t + c_3 t^3 + c_4 t^4 \\ d_0 + d_2 t^2 + c_4 t^4 \end{pmatrix}$$

$$t_0 = 0 \Rightarrow \vec{r}(t_0) = \begin{pmatrix} b_0 \\ 0 \\ d_0 \end{pmatrix} = \begin{pmatrix} 25 \\ 0 \\ 120 \end{pmatrix}$$

$$t_1 = 2.5s \Rightarrow \vec{r}(t_1) = \begin{pmatrix} 25 - 1.5 \times 2.5 + 3.5 \times 2.5^2 \\ 6.5 \times 2.5 - 1.2 \times 2.5^3 + 0.45 \times 2.5^4 \\ 120 - 4.9 \times 2.5^2 + 1.5 \times 2.5^4 \end{pmatrix} = \begin{pmatrix} 9.375 \\ 20.078 \\ 147.96875 \end{pmatrix} \approx \begin{pmatrix} 9.38 \\ 20.08 \\ 147.97 \end{pmatrix}$$

$$t_3 = 10.0s \Rightarrow \vec{r}(t_3) = \begin{pmatrix} 25 - 1.5 \times 10 + 3.5 \times 10^2 \\ 6.5 \times 10 - 1.2 \times 10^3 + 0.45 \times 10^4 \\ 120 - 4.9 \times 10^2 + 1.5 \times 10^4 \end{pmatrix} = \begin{pmatrix} 225 \\ 4465 \\ 15071 \end{pmatrix}$$

$$(b) \vec{v}(t) = \vec{r}(t)' = \begin{pmatrix} b_1 + 2b_2 t \\ c_1 + 3c_3 t^2 + 4c_4 t^3 \\ 2d_2 t + 4c_4 t^3 \end{pmatrix}$$

$$t_0 = 0 \Rightarrow \vec{v}(t_0) = \begin{pmatrix} b_1 \\ c_1 \\ 0 \end{pmatrix} = \begin{pmatrix} -15.0 \\ 8.5 \\ 0.0 \end{pmatrix}$$

$$t_1 = 2.5s \Rightarrow \vec{v}(t_1) = \begin{pmatrix} -15 + 2 \times 3.5 \times 2.5 \\ 8.5 + 3 \times (-1.2) \times 2.5^2 + 4 \times 0.45 \times 2.5^3 \\ 2 \times (-4.9) \times 2.5 + 4 \times 0.45 \times 2.5^3 \end{pmatrix} = \begin{pmatrix} 2.5 \\ 14.125 \\ 3.625 \end{pmatrix}$$

$$t_3 = 10.0s \Rightarrow \vec{v}(t_3) = \begin{pmatrix} -15 + 2 \times 3.5 \times 10 \\ 8.5 + 3 \times (-1.2) \times 10^2 + 4 \times 0.45 \times 10^3 \\ 2 \times (-4.9) \times 10 + 4 \times 0.45 \times 10^3 \end{pmatrix} = \begin{pmatrix} 55 \\ 1448.5 \\ 1702 \end{pmatrix}$$

$$(c) \vec{a}(t) = \vec{v}(t)'' = \begin{pmatrix} 2b_2 \\ 6c_3 t + 12c_4 t^2 \\ 2d_2 + 12c_4 t^2 \end{pmatrix}$$

$$t_0 = 0 \Rightarrow \vec{a}(t_0) = \begin{pmatrix} 7 \\ 0 \\ -9.8 \end{pmatrix}$$

$$t_1 = 2.5s \Rightarrow \vec{a}(t_1) = \begin{pmatrix} 7 \\ 6 \times (-1.2) \times 2.5 + 12 \times 0.45 \times 2.5^2 \\ -9.8 + 12 \times 0.45 \times 2.5^2 \end{pmatrix} = \begin{pmatrix} 7 \\ 15.95 \\ 23.95 \end{pmatrix}$$

$$t_3 = 10.0s \Rightarrow \vec{a}(t_3) = \begin{pmatrix} 7 \\ 6 \times (-1.2) \times 10 + 12 \times 0.45 \times 10^2 \\ 0 - 9.8 + 12 \times 0.45 \times 10^2 \end{pmatrix} = \begin{pmatrix} 7 \\ 4746.8 \\ 530.2 \end{pmatrix}$$