Assignment in Computer Graphics II

– Assignment 11 –

Computer Graphics and
Multimedia Systems Group
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Assignment 1 [2 Points] Form Control

Given the following Ease-function:

$$\text{ease}_{\text{exp}}(t) = \begin{cases} \dfrac{e^{2t} - 2t - 1}{2e - 4} & t \in [0, \frac{1}{2}] \\[2ex] 1 - \left(\dfrac{e^{2(1-t)} + 2t - 3}{2e - 4}\right) & t \in [\frac{1}{2}, 1] \end{cases}$$

[1.]

Which velocity curve results from this Ease-function?

Let v_0 be a speed. Determine an Ease-function of the form

$$\text{ease}_{\text{exp}}^{v_0}(t) = c \cdot \text{ease}_{\text{exp}}(t),$$

which obtains an acceleration of 0 to v_0 in the time $t = 0$ to $t = \frac{1}{2}$, where c is a sought (gesuchter) constant term.
Note: It is sufficient to consider the definition on the interval $t \in [0, \frac{1}{2}]$.

Assignment 2 [2 Points] Camera coordinate system and up-vector

A camera moves on the spiral path $\mathbf{C}(t) = \begin{pmatrix} cos(\omega t) \\ vt \\ sin(\omega t) \end{pmatrix}$, where v is the vertical speed and ω is the angular velocity (radians per second). The camera axis should always be aligned along the tangent direction.

1. Calculate the up vector. Assume that the up-vector remains the same for positive and negative direction of rotation.
2. How does the sign of its y component behaves?
3. Which value does the up vector take for $v = 0$?

Assignment 3 [2 Points] Tapering

Given the tapering function

$$r(u) = \frac{1}{5}(u+1)^2 + \frac{1}{5}$$

and a cubic Bezier curve $\mathbf{C}(t)$ with control points

$$\mathbf{C}_0 = \begin{pmatrix} 1 \\ -1 \end{pmatrix},\ \mathbf{C}_1 = \begin{pmatrix} -1 \\ -1 \end{pmatrix},\ \mathbf{C}_2 = \begin{pmatrix} -1 \\ 1 \end{pmatrix},\ \mathbf{C}_3 = \begin{pmatrix} 1 \\ 1 \end{pmatrix}.$$

[1.]

Scale the second coordinate of the given control points by using the tapering function $r(u)$. Using the new contol points, execute the De-Casteljau algorithm geometrically for $t = 0, 0.1, 0.25, 0.5, 0.75, 0.9, 1$. Sketch the curve.
Hint: Utilize the symmetry of control points.

Given the curve points:
$\mathbf{C}(0) = \begin{pmatrix} 1 \\ -1 \end{pmatrix}$, $\mathbf{C}(0.1) = \begin{pmatrix} 0.46 \\ -0.94 \end{pmatrix}$, $\mathbf{C}(0.25) = \begin{pmatrix} -0.125 \\ -0.6875 \end{pmatrix}$, $\mathbf{C}(0.5) = \begin{pmatrix} -0.5 \\ 0 \end{pmatrix}$, $\mathbf{C}(0.75) = \begin{pmatrix} -0.125 \\ 0.6875 \end{pmatrix}$, $\mathbf{C}(0.9) = \begin{pmatrix} 0.46 \\ 0.94 \end{pmatrix}$, $\mathbf{C}(1) = \begin{pmatrix} 1 \\ 1 \end{pmatrix}$.
Scale the second coordinate of these curve points by using the tapering function $r(u)$. Sketch the corresponding curve and compare it with the result from subtask 1.
Hint: Utilize the symmetry of the control points.

Hand in: Until 13.07.2017 12:00 o'clock in mailbox of our chair (next to room H-A 7107).