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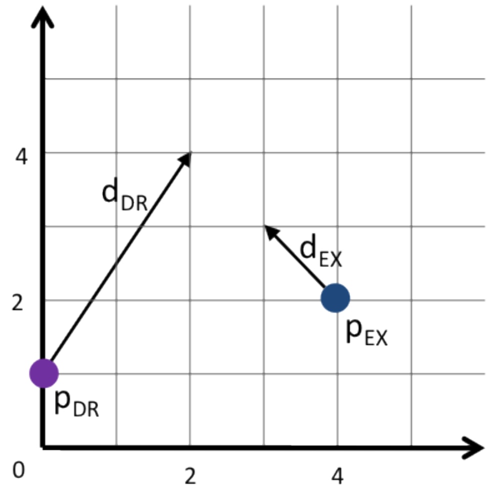
Managing Massive Multiplayer Online Games
SoSe 2018

Exercise Sheet 4: Conflict management and dead reckoning

Discussion: May 9th, 2018

Exercise 4-1 *Hermite-Interpolation* **(Tutorial Exercise)**

The following situation of an abstract game on a two-dimensional field is given: The position of a player and his direction of movement at time t are given by dead reckoning with a position vector p_{DR} and a movement vector d_{DR} At the same time an update from the server arrives with the real position vector and movement vector $p_{\text{EX}}, d_{\text{EX}}$.



Now the client has to transfer position and movement which were calculated with dead reckoning to the actual data within a time window δ. On account of simplicity one can assume that within a time window δ a player moves exactly by the length of a movement vector. In other words, at time $t + \Delta t$ the player should be at position $p_{\text{EX}} + d_{\text{EX}}$.

The following vectors are given:

$$p_{\text{DR}} = \begin{pmatrix} 0 \\ 1 \end{pmatrix} \quad d_{\text{DR}} = \begin{pmatrix} 2 \\ 3 \end{pmatrix} \quad p_{\text{EX}} = \begin{pmatrix} 4 \\ 2 \end{pmatrix} \quad d_{\text{EX}} = \begin{pmatrix} -1 \\ 1 \end{pmatrix}$$

Illustrate the idea of position correction with linear combination of Hermite-functions as described in the script (chapter 3, page 20). For that calculate the value of the linear combination function $\hat{p}(x)$ (see below) for $x \in \{1/2, 7/8\}$. Mark these points in the plot and sketch your idea of the corresponding connecting curve based on these.

$$h_1(x) = 2x^3 - 3x^2 + 1 \qquad h_2(x) = -2x^3 + 3x^2$$
$$h_3(x) = x^3 - 2x^2 + x \qquad h_4(x) = x^3 - x^2$$

$$\hat{p}(x) = p_{\text{DR}} \cdot h_1(x) + (p_{\text{EX}} + d_{\text{EX}}) \cdot h_2(x) + d_{\text{DR}} \cdot h_3(x) + d_{\text{EX}} \cdot h_4(x)$$

where $x \in [0, 1]$ describes the progress of movement between time t and time $t + \Delta t$.