

CS 4620 Homework 5: Quaternion Interpolation and Viewing

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Problem 1: Quaternion Interpolation (An exercise in SLERP'ing)

Using spherical linear interpolation (SLERP), interpolate halfway between the two quaternions $q = \langle 1; (1, 1, 1) \rangle$ and $r = \langle 1; (1, 0, 0) \rangle$ (*Hint: Are they unit quaternions?*).

Problem 2: Viewing (Shirley and Marschner (3rd ed.), Ch.7, Question 2)

“Multiply the viewport and orthographic projection matrices, and show that the result can also be obtained by a single application of Equation (6.7)”

$$\begin{bmatrix} \frac{x'_h - x'_l}{x_h - x_l} & 0 & 0 & \frac{x'_l x_h - x'_h x_l}{x_h - x_l} \\ 0 & \frac{y'_h - y'_l}{y_h - y_l} & 0 & \frac{y'_l y_h - y'_h y_l}{y_h - y_l} \\ 0 & 0 & \frac{z'_h - z'_l}{z_h - z_l} & \frac{z'_l z_h - z'_h z_l}{z_h - z_l} \\ 0 & 0 & 0 & 1 \end{bmatrix} \quad (6.7)$$

Problem 3: Viewing (Shirley and Marschner (3rd ed.), Ch.7, Question 11)

“Show, that for a perspective transform, line segments that start in the view volume do map to line segments in the canonical volume after homogenization. Further, show that the relative ordering of points on the two segments is the same. (*Hint: Show that $f(t)$ in Equation (7.8)*”

$$f(t) = \frac{w_R t}{w_r + t(w_R - w_r)}. \quad (7.8)$$

has the properties $f(0) = 0$, $f(1) = 1$, the derivative of f is positive for all $t \in [0, 1]$, and the homogeneous coordinate does not change sign.”