Modules 7 & 8 Assignment - Problems

Prob1. Suppose the motion between two adjacent frames $f_1$ and $f_2$ can be described by global affine mapping as,

$$dx(x, y) = a_0 + a_1 x + a_2 y$$
$$dy(x, y) = b_0 + b_1 x + b_2 y$$

Set up the optimization problem using the OFE approach and derive a closed form solution for the affine parameters.

Prob2. a) State the conditions on the (R,G,B) intensities of a color image so that we have at least two linearly independent equation at each pixel to solve the OFE.

b) How valid are these conditions for general color image?

Prob3. Show that the constraint of $\frac{d}{dt} \nabla \psi(\vec{x}, t) = 0$ does not hold when there is rotation or zoom.

Prob4. 3-D rotation in Cartesian coordinates can be characterized either by the Eulerian angles of rotation $\theta, \psi, \phi$ of rotation about the X, Y and Z-axes, or by an angle about an arbitrary axis through the origin specified by directional cosines $n_1, n_2, n_3$. Show that the two descriptions are equivalent under the assumption of infinitesimal rotation.

Prob5. Derive the number of operations required by HBMA if one uses a search range of $\pm 1$ pel at every level, except at the first level where the search range is set to $R/2^{L-1}$?

Prob6. Assume a pinhole camera with F=9mm; a target of 1" x 1.33" and an image size of 352 x 288 pels. Assume object point is at a distance of 2m from camera lens. How much does the object point move in Z-direction in order to move its image point by 1 pixel?