Homework 4 – CE603, 2007

Assigned Monday 2 april, due 1 week

- Make a matlab function that evaluates the condition equations for point A7 on the lafayette quickbird scene.
- Use the following values for the kepler elements

```
kep_a=1.0e+004 *0.682312458946782;%(km)
kep_e=1.0e+004 *0.000000136743047;
inc=1.0e+004 *0.00016962555809;%(rad)
OMEGA_0=1.0e+004 *-0.000002734315594;%(rad)
OMEGA_1=1.0e+004 *0.000000000016256;%(rad/s)
w0=1.0e+004 *0.00011672193127;%(rad)
w1=1.0e+004 *0.000000000002086;%(rad/s)
tp=1.0e+004 *5.98735429392577 9;%time at perigee (seconds of the day)
tL1=16*3600+57*60+27.463116;%time at first line (seconds of the day)
```

- Download and review the quickbird product guide from the digital globe website. Look specifically for the description and location of the camera parameters (focal length, principal point), coordinate system definitions, ephemeris data, attitude data (quaternions), line rate, …
- Use an image coordinate system which is centered at the perspective center, z-up, x in the direction of motion
- Inside the function:
  - Find time for the image line
  - Interpolate (linear by quaternion elements, then normalizing) an attitude
  - Remember above is with respect to ECF (modify with result below)
  - Convert lat,lon,h to XYZ-ECF
  - Obtain M(ECF->ECI) and use to get XYZ-ECI (of ground point)
  - At given time obtain M, convert to E, then f then convert kepler elements to instantaneous $X_L Y_L Z_L$ (of exposure station)

$$\begin{bmatrix} 0-x_0 \\ y-y_0 \\ -f \end{bmatrix} = \lambda \mathbf{M} \left[\begin{pmatrix} X \\ Y \\ Y \end{pmatrix}_{ECI} - \begin{pmatrix} X_L \\ Y_L \\ Z_L \end{pmatrix}_{ECI} \right]$$

$$\begin{bmatrix} 0-x_0 \\ y-y_0 \\ -f \end{bmatrix} = \begin{bmatrix} U \\ V \\ W \end{bmatrix}$$

$$\begin{bmatrix} F_x \\ F_y \end{bmatrix} = \begin{bmatrix} -x_0 + f\dfrac{U}{W} \\ y-y_0 + f\dfrac{V}{W} \end{bmatrix}$$