Satellite Photogrammetry Topics -- Spring 2017

course web page: http://engineering.purdue.edu/~bethel/photo2_17
(up later this week)

no textbook
recommended references:
1. pleiades use guide (math model), on website
2. building earth observation cameras, george joseph (system design)
3. physical principles of remote sensing, rees (radiometry)
4. notes from earlier versions of this course

2 exams: each 25%
HW: 50%
homeworks are a sequence of tasks implement the math model for
worldview X, each one depends on correctness of previous ones

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motivation for mirror optics: chromatic aberration, weight
on-axis vs. off-axis telescope design
history of satellite remote sensing
synchronous vs. asynchronous scanning
digital globe: worldview 1,2,3

reference coordinate systems
coordinate transformations
  (1) phi,lambda,h -> cartesian, ECF, closed form
  (2) ECF -> phi, lambda, h, iterative
  (3) ECF -> local cartesian (topocentric)
support data: .geo, .imd, .rpb, .eph, .att
rotation parameters:
  (1) euler angles (roll, pitch, yaw), singularities
  (2) direction cosines
  (3) quaternions
  (4) axis-angle
image to ground algorithm
systematic errors:
  (1) atmosperic refraction
  (2) velocity aberration
matlab functions needed:
  (1) [X;Y;Z]'=FI2G(l,s,h)
  (2) [PHI; LAM]'=FI2G_PL(l,s,h), just a wrapper
  (3) [dPHI; dLAM]'=FI2G_PL_0(l,s,h,phi,lam), just a wrapper
  (4) [l;s]=FG2I(phi,lambda,h), solve eqn (3) for l,s by iteration
      verify that (2) & (4) are inverses
adjustable parameters
resection (refine EO given GCP's)
2-image triangulation with tie points and GCP's
replacement model
  standards for replacement model parameters
  coordinate normalization
  solving singular NE
  verify accuracy
setup stereo model in LPS
image interpolation
  nearest neighbor
  bilienear
  bicubic
image pyramid
orthorectification
integrate with vectors in ArcGIS
radiometric units
radiometry, radiometric design
resolution, resolving power
mission design
CCD operation

(probably not time for all these topics, maybe some)
orbit mechanics, 2-body problem
transformation state vector <-> kepler elements
time concepts solar, sidereal, ut1, utc, tai, gps, gast, JD, MJD
transformation ECF <-> ECI, precession, nutation, GAST, polar motion
velocity transformation
circular error derivation
SIFT tie point generation for triangulation
openGL quad buffered & anaglyph stereo
