**Seismic Resistant Design of Steel Structures**

**Design Project (Assignment #4) 5:00PM on 6/19/2018**

（1）Check the two ground motion records (CHY076EW.txt, CHY076SN.txt) and the corresponding 5% damped acceleration response spectra (CHY076EW_sp.txt, CHY076SN_sp.txt), report the PGAs of these two ground accelerations.

（2）Construct the nonlinear 3D frame model using PISA3D program. There is no need to include the panel zone element or rigid end offsets in your 3D model. Consider the P-$\Delta$ effects by using the leaning columns. Whenever possible, use hardening material for BRBs and links in EBFs, and bi-linear material model for all FCE. Apply the lateral forces considering the force pattern found in the Assignment #3 from the CQC combination rule. Conduct the nonlinear pushover analysis separately for both X and Y directions to a roof drift of 2.5% radians. Plot the base shear (vertical axis) versus the roof drift angle (horizontal axis) relationships for the X and Y directions. Mark the static LRFD design base shear and estimate the system over-strength factor, $\Omega_o$ in both directions.

（3）Plot to compare the two 5% damped normalized (to the same PGA) response spectra of the given time histories and the design spectrum of the soil profile type 1 suggested in Assignment #1. Mark the first two fundamental periods ($T_{1x,}$ $T_{2x,}$ $T_{1y,}$ $T_{2y}$) in the two principal axes of the 3D frame on the plot.

（4）Apply the ground motions in the EW and NS direction according to the building orientation given in Assignment #1. Assume the structural system damping ratio is 2%. Use the same PISA3D model to conduct the incremental dynamic analysis (IDA) in each direction separately. Set the PGAs as: 0.08g, 0.15g, 0.23g, 0.30g, 0.33g and 0.42g. Plot the peak base shear versus peak roof drift angle relationships obtained from these time history response analyses. Plot to compare the curve obtained from the IDA with the static pushover response obtained in Step (1) for X and Y directions, separately.

（5）Use GISA3D program to illustrate the maximum lateral deformations and plastic hinge distributions of the 3D frame model you designed under the applications of two different ground motion intensities of PGA=0.33g and PGA=0.42g.

（6）Discuss the seismic performance of your design. (At least 300 words are required.)