# Data Processing: Strain Estimation (FEM)


### *Summary:*

This data set is from a Finite Element Modeling (FEM) simulation. The simulation has 4 inclusions in an otherwise homogeneous background. The inclusions are 10-, 20-, 30-, and 40-dB stiffer than the background.


### *File and Naming Formats:*

Twenty five (25) sets were simulated to calculate statistics such as SNRe, CNRe, MSSIM, etc. (25 sets are adequate to get a reliable measure of statistics.)

Each set includes files **`PhnDyn12_x-00.eye`**, **`PhnDyn12_x-01.eye`**, **`PhnDyn12_x-02.eye`**, **`PhnDyn12_x-04.eye`**, **`PhnDyn12_x-06.eye`**, **`PhnDyn12_x-08.eye`**, **`PhnDyn12_x-12.eye`**, and **`PhnDyn12_x-16.eye`**. **`x`** is the simulation number and can have a value of **`1`** through **`25`**.

Accordingly, the files for simulation **`1`** are:

1. **`PhnDyn12_1-00.eye`**: pre compression file
2. **`PhnDyn12_1-01.eye`**: post compression file (1% strain)
3. **`PhnDyn12_1-02.eye`**: post compression file (2% strain)
4. **`PhnDyn12_1-04.eye`**: post compression file (4% strain)
5. **`PhnDyn12_1-06.eye`**: post compression file (6% strain)
6. **`PhnDyn12_1-08.eye`**: post compression file (8% strain)
7. **`PhnDyn12_1-12.eye`**: post compression file (12% strain)and
8. **`PhnDyn12_1-16.eye`**: post compression file (16% strain)

The files in *.eye format can be read using the **`ReadEye.m`** file.

### *Processing:*

Strain can be estimated using any “standard” strain estimation routine. The straightforward processing is as follows (only using the simulation number **`1`**). Feel free to customize as needed.

```
% APPLIED STRAIN = 1%
rf1 = ReadEye('PhnDyn12_1-00.eye'); % PRE COMPRESSION
rf2 = ReadEye('PhnDyn12_1-01.eye'); % POST COMPRESSION
% COMPUTE STRAIN MAPS USING THE COMMON ROUTINES
helpwin EstStrn
[s,d,c] = EstStrn(rf1,rf2,192,128,64,0.01,0,0.02,'g'); % GRADIENT
figure(1), imagesc(s), colorbar
[s,d,c] = EstStrn(rf1,rf2,192,128,64,0.01,0,0.02,'ls'); % LSQ
figure(2), imagesc(s), colorbar
[s,d,c] = EstStrn(rf1,rf2,192,128,64,0.01,0,0.02,'us'); % UNIFORM STRETCHING
figure(3), imagesc(s), colorbar
[s,d,c] = EstStrn(rf1,rf2,192,128,64,0.01,0,0.02,'lsus'); % UNIFORM STRETCHING
+ LEAST SQUARES
figure(4), imagesc(s), colorbar
[s,d,c] = EstStrn(rf1,rf2,192,128,64,0.01,0,0.02,'a'); % ADAPTIVE STRETCHING
figure(5), imagesc(s), colorbar
```

```
% APPLIED STRAIN = 2%
rf1 = ReadEye('PhnDyn12_1-00.eye'); % PRE COMPRESSION
rf2 = ReadEye('PhnDyn12_1-02.eye'); % POST COMPRESSION
[s,d,c] = EstStrn(rf1,rf2,192,128,64,0.02,0,0.04,'ls'); % NOTE STRAIN VALUES
figure(1), imagesc(s), colorbar
[s,d,c] = EstStrn(rf1,rf2,192,128,64,0.02,0,0.04,'us');
figure(2), imagesc(s), colorbar
[s,d,c] = EstStrn(rf1,rf2,192,128,64,0.02,0,0.04,'lsus');
figure(3), imagesc(s), colorbar
[s,d,c] = EstStrn(rf1,rf2,192,128,64,0.02,0,0.04,'a');
figure(4), imagesc(s), colorbar

% APPLIED STRAIN = 4%
rf1 = ReadEye('PhnDyn12_1-00.eye'); % PRE COMPRESSION
rf2 = ReadEye('PhnDyn12_1-04.eye'); % POST COMPRESSION
[s,d,c] = EstStrn(rf1,rf2,192,128,64,0.04,0,0.08,'ls'); % NOTE STRAIN VALUES
figure(1), imagesc(s,[0 0.08]), colorbar
[s,d,c] = EstStrn(rf1,rf2,192,128,64,0.04,0,0.08,'us');
figure(2), imagesc(s,[0 0.08]), colorbar
[s,d,c] = EstStrn(rf1,rf2,192,128,64,0.04,0,0.08,'lsus');
figure(3), imagesc(s,[0 0.08]), colorbar
[s,d,c] = EstStrn(rf1,rf2,192,128,64,0.04,0,0.08,'a');
figure(4), imagesc(s,[0 0.08]), colorbar

% WE CAN ALSO PROCESS FOR 6, 8, 12, AND 16 PERCENT
```