Validation-SimpleSupportBeam-CustomerLikelihood

This example is on Bayesian inversion - Simple beam | Examples | UQLab with known forward model. This document is a test to see how Uqlab customerLikelihood works.

1 - INITIALIZE UQLAB

```
clearvars
rng(100,'twister')
uqlab
```

```
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This is UQLab, version 2.0
UQLab is distributed under the BSD 3-clause open source license available at:
F:\abaqustemp\UQLab_Rel2.0.0\UQLab_Rel2.0.0\LICENSE.

To request special permissions, please contact:
  - Stefano Marelli (marelli@ibk.baug.ethz.ch).

Useful commands to get started with UQLab:
uqlab -doc           - Access the available documentation
uqlab -help          - Additional help on how to get started with UQLab
uq_citation help   - Information on how to cite UQLab in publications
uqlab -license       - Display UQLab license information
```
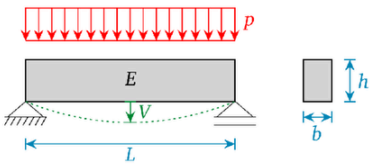

2 - PRIOR DISTRIBUTION



The forward model $V = \frac{5pL^4}{32Ebh^3}$ in inbuilt in the logLikelihood function, b,h,L are constants are not shown in the prior

```
%Priors on E and p
PriorOpts.Marginals(1).Name = 'E';                % Young's modulus
PriorOpts.Marginals(1).Type = 'LogNormal';
PriorOpts.Marginals(1).Moments = [30 4.5]*1e9;    % (N/m^2)

PriorOpts.Marginals(2).Name = 'p';                % uniform load
PriorOpts.Marginals(2).Type = 'Gaussian';
PriorOpts.Marginals(2).Moments = [12000 600]; % (N/m)

% Discrepancy parameters
PriorOpts.Marginals(3).Name = 'sigma2'; % variance
```

```
PriorOpts.Marginals(3).Type = 'Uniform';
PriorOpts.Marginals(3).Parameters = [0 0.01259^2]; % (m^2) Consistent with given example
myPriorDist = uq_createInput(PriorOpts);
```

3 - Define the custom-loglikelihood

```
myLogLikeli = @(params,y) myLOGlikeli(params,y);
```

4 - MEASUREMENT DATA

```
%Consistent with given example
myData.y = [12.84; 13.12; 12.13; 12.19; 12.67]/1000; % (m)
myData.Name = 'Mid-span deflection';
```

5 - Bayes Analysis

Consistent with example

```
BayesOpts.Data = myData;
BayesOpts.LogLikelihood = myLogLikeli;
BayesOpts.Type = 'inversion';
BayesAnalysis = uq_createAnalysis(BayesOpts);
```

```
The solver was not specified, using MCMC
The sampler was not specified, using affine invariant ensemble sampler
Starting AIES...

|################################| 100.00%

Finished AIES!
```

6 - Postprocess results

Ground truth should be:

```
%------------------ Posterior Marginals
------------------------------------------------------------------------
| Parameter | Mean     | Std      | (0.025-0.97) Quant.  | Type        |
------------------------------------------------------------------------
| E         | 2.4e+10  | 2.1e+09  | (2.1e+10 - 3e+10)    | Model       |
| p         | 1.2e+04  | 5.9e+02  | (1.1e+04 - 1.3e+04)  | Model       |
| Sigma2    | 4.2e-06  | 1.3e-05  | (1e-07 - 3.8e-05)    | Discrepancy |
------------------------------------------------------------------------

%------------------ Point estimate
---------------------------------------
| Parameter | Mean     | Parameter Type |
---------------------------------------
| E         | 2.4e+10  | Model          |
| p         | 1.2e+04  | Model          |
| Sigma2    | 4.2e-06  | Discrepancy    |
```

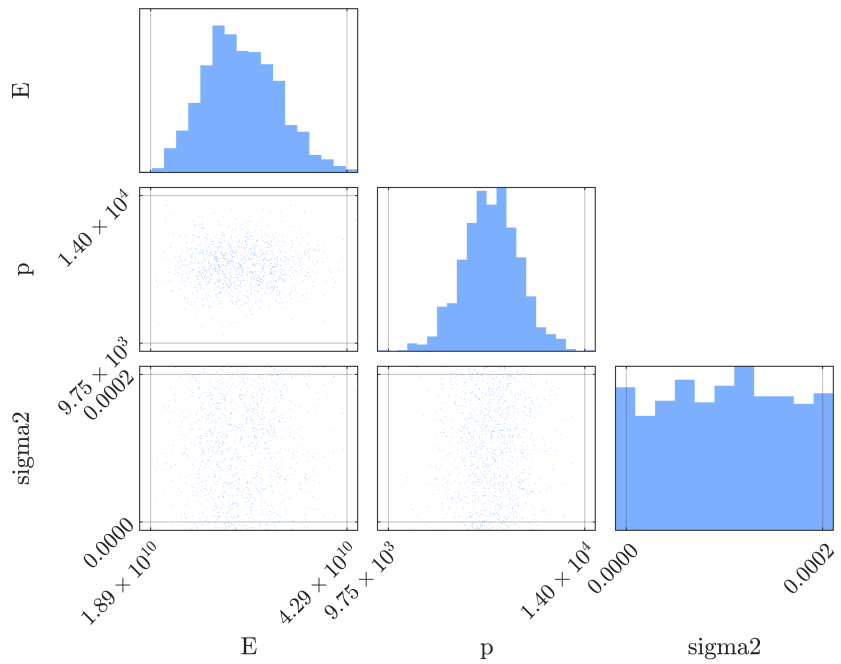
```
uq_print(BayesAnalysis)
```

```
%----------------------- Inversion output -----------------------%
   User-specified likelihood used
%------------------- Solver
   Solution method:                                MCMC

   Algorithm:                                      AIES
```

```
   Duration (HH:MM:SS):                          00:02:12
   Number of sample points:                      3.00e+04

%------------------- Posterior Marginals
-------------------------------------------------------------------
| Parameter | Mean    | Std     | (0.025-0.97) Quant. | Type   |
-------------------------------------------------------------------
| E         | 2.9e+10 | 4.3e+09 | (2.2e+10 - 3.9e+10) | Model |
| p         | 1.2e+04 | 6e+02   | (1.1e+04 - 1.3e+04) | Model |
| sigma2    | 9.4e-05 | 4.1e-05 | (1.5e-05 - 0.00015) | Model |
-------------------------------------------------------------------

%------------------- Point estimate
-----------------------------------------
| Parameter | Mean    | Parameter Type |
-----------------------------------------
| E         | 2.9e+10 | Model          |
| p         | 1.2e+04 | Model          |
| sigma2    | 9.4e-05 | Model          |
-----------------------------------------

%------------------- Correlation matrix (model parameters)
---------------------------------------
|        |  E       p        sigma2  |
---------------------------------------
| E      |  1       0.02     0.14    |
| p      |  0.02    1        -0.07   |
| sigma2 |  0.14    -0.07    1       |
---------------------------------------
```

```
uq_display(BayesAnalysis);
```

Prior Sample



Posterior Sample