Cantilever Beam Displacement Function

# Usage:

The Cantilever Beam Displacement function, used for uncertainty quantification, models a simple uniform cantilever beam with horizontal and vertical loads. It calculates the displacement at the free end of the beam, in .

# Description:

The displacement , in is determined by the following equation:

where: : Young’s modulus of beam material

: horizontal load

: vertical load

: length of the beam

: width of the cross-section of the beam

: thickness of the cross-section of the beam

In this problem we have three independent random variables: and three independent deterministic variables .

# Inputs:

|  |  |  |  |
| --- | --- | --- | --- |
| Variable | Description | Distribution | Statistics |
|  | Young’s modulus of beam material | Normal | , |
|  | Horizontal load | Normal | , |
|  | Vertical load | Normal | , |
|  | Length of beam | Deterministic |  |

# Files:

List of the function files:

* uq\_CantileverBeamDisplacement.m (vectorised implementation of the function)
  + Input as uq\_CantileverBeamDisplacement(X, P):

List of applications and the corresponding UQLab input files:

* Sensitivity Analysis
  + uq\_Example\_Sensitivity\_05\_CantileverBeam\_Displacement.m
* Surrogate modelling
  + uq\_Example\_PCE\_CantileverBeam\_Displacement.m

# References:

**Reliability analysis:**

Eldred, M. S., Agarwal, H., Perez, V. M., Wojtkiewicz Jr, S. F., & Renaud, J. E. (2007). Investigation of reliability method formulations in DAKOTA/UQ. Structure and Infrastructure Engineering, 3(3), 199-213.

Sues, R., Aminpour, M., & Shin, Y. (2001, April). Reliability-based multidisciplinary optimization for aerospace systems. In Proc. 42rd AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, number AIAA-2001-1521, Seattle, WA (Vol. 342).

**Surrogate modelling:**

Eldred, M. S., & Burkardt, J. (2009, January). Comparison of non-intrusive polynomial chaos and stochastic collocation methods for uncertainty quantification. In Proceedings of the 47th AIAA Aerospace Sciences Meeting and Exhibit, number AIAA-2009-0976, Orlando, FL (Vol. 123, p. 124).

Eldred, M. S., Webster, C. G., & Constantine, P. (2008, April). Evaluation of non-intrusive approaches for Wiener-Askey generalized polynomial chaos. In Proceedings of the 10th AIAA Non-Deterministic Approaches Conference, number AIAA-2008-1892, Schaumburg, IL (Vol. 117, p. 189).

**Reliability-based design optimization:**

Wu, Y. T., Shin, Y., Sues, R., & Cesare, M. (2001, April). Safety-factor based approach for probability-based design optimization. In Proc. 42nd AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, number AIAA-2001-1522, Seattle, WA (Vol. 196, pp. 199-342).