ON A SANDIA STRUCTURAL
MECHANICS CHALLENGE PROBLEM

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A few days before the 13th PANM Conference in Prague, a Validation Challenge Workshop hosted by Sandia National Laboratories will take place in Albuquerque, NM, USA. The workshop will focus on validation methods demonstrated through solving challenge problems posted on the Web [1].

This contribution deals with the Structural Mechanics Challenge Problem [2]. The problem goal is to predict whether or not a bar structure will break a safety displacement limit if a given load is applied to the structure. The structure geometry and the structure load are known exactly, but the problem is made harder by the partial lack of information about E, the Young modulus of the material of the bars. In this respect, the analyst's decision has to be based on a few values originating from measurements performed on samples. These values consist of (a) five local values of E, (b) five values of E derived from "short" bar elongations, (c) two values of E derived from "long" bar elongations, and (d) one displacement of a loaded bar structure that is, to some extent, similar to the analyzed structure.

Although the number of measurements is too low for a reliable statistical analysis, a partly probabilistic approach can be used to address the challenge problem. Under certain hypotheses about the probability density and correlation functions, it is possible to estimate the mean and the standard deviation of the predicted displacement. In this way, the analyst can obtain incomplete but still valuable information about the behavior of the investigated structure.

References

[1] http://www.esc.sandia.gov/VCWwebsite/vcwOverviewAndGoals.html
[2] http://www.esc.sandia.gov/VCWwebsite/MechanicsProblemDescrip.pdf