Uncertainty analysis by point estimate methods incorporating marginal distributions

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Abstract: The model performance of an engineering system is affected by many variables subject to uncertainty. Point estimate (PE) methods are practical tools to assess the uncertainty features of a model involving multivariate stochastic parameters. Two PE methods have been developed for engineering applications. One is Rosenblueth's PE method, which preserves the first three moments of random variables and the other is Harr's PE method, which reduces the computations of Rosenblueth's method but only as appropriate for application to random variables with normal distributions. In this study, two algorithms are proposed to encompass the advantages of the two PE methods: computational practicality and the handling of mixture distributions. Through a numerical experiment, the proposed methods yielded more accurate estimations than those of Rosenblueth's method with about the same amount of computation as Harr's method. The two proposed methods were also applied to estimate statistical moments of a pier scouring model output to demonstrate their performance in an engineering application. (14 refs.)