

# Methodology for estimating strain gauge measurement biases and uncertainties

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## **Abstract**

Compared to actual strains, the values obtained with strain gauges during experimental measurements contain biases and uncertainties. In this paper, we propose a methodology using Monte Carlo simulations to estimate the effects of biases and uncertainties from the following: location uncertainty, integration effect and transverse sensitivity errors in unidirectional strain gauges. Moreover, the specific behaviour of welded gauges is also considered. The approach simulates strain gauges on the displacement fields obtained from the structure's Finite Element Analyses (FEA) to predict the expected biases and uncertainties. With the use of experimental measurements designed to highlight the biases between gauge measurements and FEA strain results, we validate the methodology. In our experimental validation, we observe that biases are adequately predicted by the proposed method. It is worth mentioning that such an approach can be used not only for validations between FEA and experimental measurements, but also for optimizations of strain gauge positioning during measurement campaigns.