

**SECOND-ORDER INVERSE RELIABILITY ANALYSIS: A NEW METHODOLOGY TO THE TREATMENT OF  
RELIABILITY IN ENGINEERING SYSTEM**

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**Abstract:** Reliability-Based methods have been established to take into account, in a rigorous manner, the uncertainties involved in the analysis of engineering systems. The failure probability and the reliability index are used to quantify risks and therefore evaluate the consequences of failure. First/second-order reliability method (FORM/SORM) is considered to be one of the most reliable computational methods to deal with reliability in engineering systems. Basically, the idea is to overcome the computational difficulties in the determination of the reliability index and approximating the constraints. In this contribution, a new methodology for the treatment of uncertainties in engineering systems is proposed. This approach, called Second-Order Inverse Reliability Analysis (SOIRA), consists in the use of first and second order derivatives in order to reduce the number of objective function evaluations in relation to other classical approaches to deal with reliability. In order to evaluate the proposed methodology, three reliability approaches (FORM, SORM and IRA) are applied in two test cases: i) W16X31 steel beam problem and ii) beam problem. The obtained results demonstrated that the proposed strategy represents an interesting alternative in the treatment of reliability, in terms of results and number of objective function evaluations, in comparison with those obtained by other classical approaches.