# Optimizing snap-through structures by using gradient-only algorithms

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**Abstract**

This paper presents a robust technique to design snap-through structures. The structural analysis of the snap-through structure makes use of an arc length control algorithm. To ensure robustness, the prescribed arc length per increment is halved whenever complex roots are encountered in the arc length control algorithm, or when the required number of Newton-Raphson iterations exceeds five. The resulting structural analysis is robust, but now different analyses makes use of different increment sizes. The resulting optimization problem, which minimizes the error between a target load-deflection curve and the simulated curve, now contains numerical discontinuities. We demonstrate how gradient-only optimization algorithms can robustly optimize such problems.

**Keywords:** snap-through; arc length control; gradient-only optimization.