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Shape manifold learning for optimization and inverse analysis

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Abstract

In this paper, we propose a novel approach of reduced order shape representation. The overall idea is to represent a structure in the space of admissible shapes by means of projection of the level-set representation on a set of carefully chosen basis vectors. This allows us to identify the intrinsic dimensionality of the problem, independently of the original design parameters. Also, an optimal parameterization may be obtained for arbitrary shapes, where the parameters have to be defined a posteriori. This allows us to build predictor-corrector optimization "manifold walking" algorithms in a reduced shape space that guarantee the admissibility of the solution with no additional constraints. Several recent applications will be presented such as shape optimization of car engine intake duct, minimizing springback effect in 3D stamping process and identification of material parameters by image correlation.

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