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SOFT HANDLE TRIGGERING. A CAD-FREE PARAMETERIZATION TOOL FOR ADJOINT–BASED OPTIMIZATION METHODS

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In gradient–based optimization methods, such as in adjoint–based methods, after having computed the sensitivities, the necessary shape changes should be applied. The sensitivity vector is often affected by numerical noise, due to the limited resolution of the discretization schemes, thus it cannot be used directly to change the shape, because the resulting shape might contain noisy surfaces which may be infeasible to be manufactured.

In this work, a CAD–free parameterization tool is proposed, based on [1], which aims to enforce smoothness to the resulting shape. A subset of the nodes belonging to the surface are selected as handles/parameters and are responsible for controlling the surface changes. The displacement field of the surface nodes attempt to match the target displacement field of the handles, whilst ensuring that, smoothness requirements are enforced.

After having changed the boundaries, the volume mesh should also be adapted to the updated geometry so as to to proceed with the optimization. One way to achieve this is by re–meshing, but the process is time–consuming and difficult to automate. An efficient alternative is to adapt the existing mesh to the updated boundaries by using a mesh morpher. Herein, the Finite Transformation Rigid Motion Mesh Morpher [2] is used to adapt the mesh to the necessary shape changes. The efficiency of the proposed parameterization tool is demonstrated as a standalone tool and as constituent of a discrete adjoint solver.

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