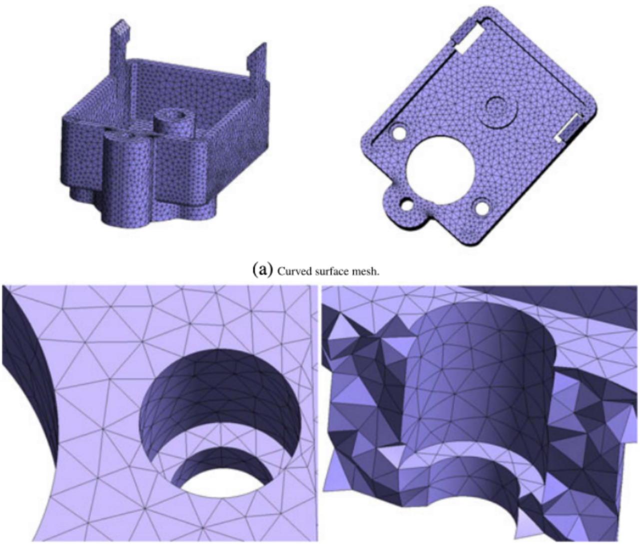
For obvious numerical reasons, we cannot accept elements with zero volume. It is necessary to strengthen a bit the previous criteria; if ω_{min} is the smallest volume of elements on the initial mesh, we impose $\omega_{K^0}(\theta) > \lambda\ \omega_{min}$. In practise, we have chosen $\lambda = 0.9$.

The algorithm is thus the following:

0. Create the subdivided mesh $\mathcal{T}^0$.
1. Solve for g in $\mathcal{T}^0$.
2. Look for the smallest θ, say θ_0, such that for any $\theta \in [0, \theta_0[$, $\omega_{K^0}(\theta) > \lambda\ \omega_{min}$ for any K^0 in $\mathcal{T}^0$, then
   - If $\theta_0 > 1$, the final mesh is obtained, go to step 3.
   - If $\theta_0 < 1$, then update the mesh following (12), denote this new mesh as $\mathcal{T}^0$ and go to step 1.
3. Recompose the curved mesh from the final $\mathcal{T}^0$.

We cannot prove if the algorithm is converging, but all the experiments we have done show a very fast convergence, even for very deformed final meshes. The next section reports some of the tests we have done.

Remark 4.2 (About the creation of the subdivided mesh)
If the subdivision of the $\mathbb{P}^1$ mesh by adding the Lagrange points is unique on dimension two, this is not true on dimension three. Indeed, each tetrahedron is decomposed on eight tetrahedra, four of them are composed by one vertex of the $\mathbb{P}^1$ tetrahedron and the middle of its adjacency edges; for creating the four others, there are three possible configurations, see Figure 8. During the first step of the algorithm, we have to make a choice and we decide for each tetrahedron to take the configuration composed with the tetrahedra having the maximum volume. In severe configurations



(a) Curved surface mesh.

(b) On the left: zoom on the curved surface, on the right: volumic cut on the tetrahedron.

Figure 9. Meshes for a mechanical piece. (a) Curved surface mesh and (b) on the left: zoom on the curved surface, on the right: volumic cut on the tetrahedron.

DOI: 10.1002/fld