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Smooth cubic spline spaces on unstructured quadrilateral meshes with particular emphasis on extraordinary points: Geometric design and isogeometric analysis considerations

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**Highlights**

- We present a framework for building smooth splines on meshes with extraordinary points.
- The spline spaces possess several desirable properties for both CAD and IGA.
- Vertex-based, smooth, linearly independent splines are used for modeling geometries.
- Compatible design and analysis spaces imply exact satisfaction of all patch tests.
- Optimal or almost-optimal convergence rates are achieved in typical analysis situations.