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Efficient construction of multi-block volumetric spline parameterization by discrete mask method.

Summary: Isogeometric analysis attempts to unify the mathematical languages in design and analysis to realize the seamless integration of CAD and CAE. In three-dimensional isogeometric analysis, parametric volume is employed as the computational domain for a given set of boundary information. In this paper, we propose a discrete mask method for the efficient construction of multi-block volumetric parameterization based on a set of given boundary spline surfaces. Given the block-partition information of a model, the interior control points can be obtained efficiently by solving a sparse linear system. The existence and uniqueness of the solution for the linear system are also proved. After performing a pre-process on the non-compatible boundary surfaces, the discrete Coons mask is generalized to a unified form, which provides more choices for the construction of inner control points. The proposed method is not only suitable for the multi-block case with $C^1$ continuity, but can also be used for the case in which the boundary surfaces are of different degrees, and with different number of control points and knot vectors. Several examples are presented to illustrate the effectiveness of the proposed method.

Keywords: isogeometric analysis; volumetric parameterization; discrete mask; multi-block
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