NURBS-Compatible Subdivision

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Our target

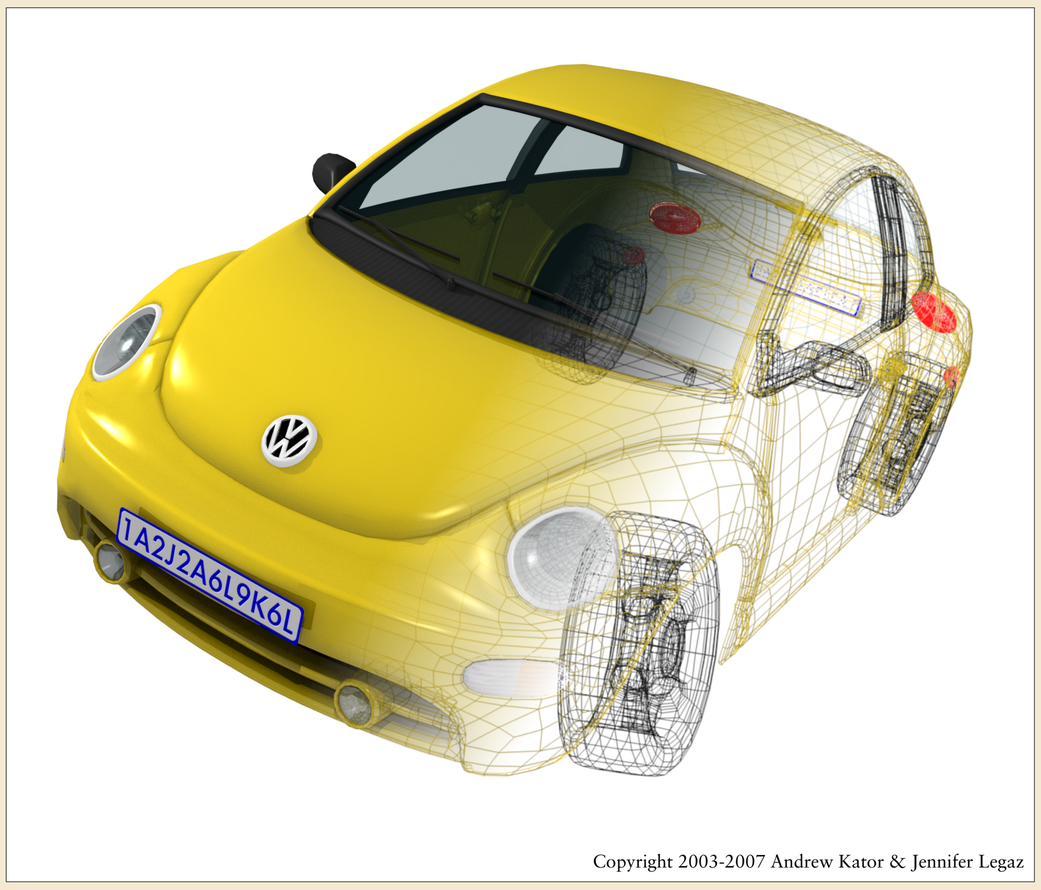
NURBS and subdivision are competing methods for designing smooth surfaces.

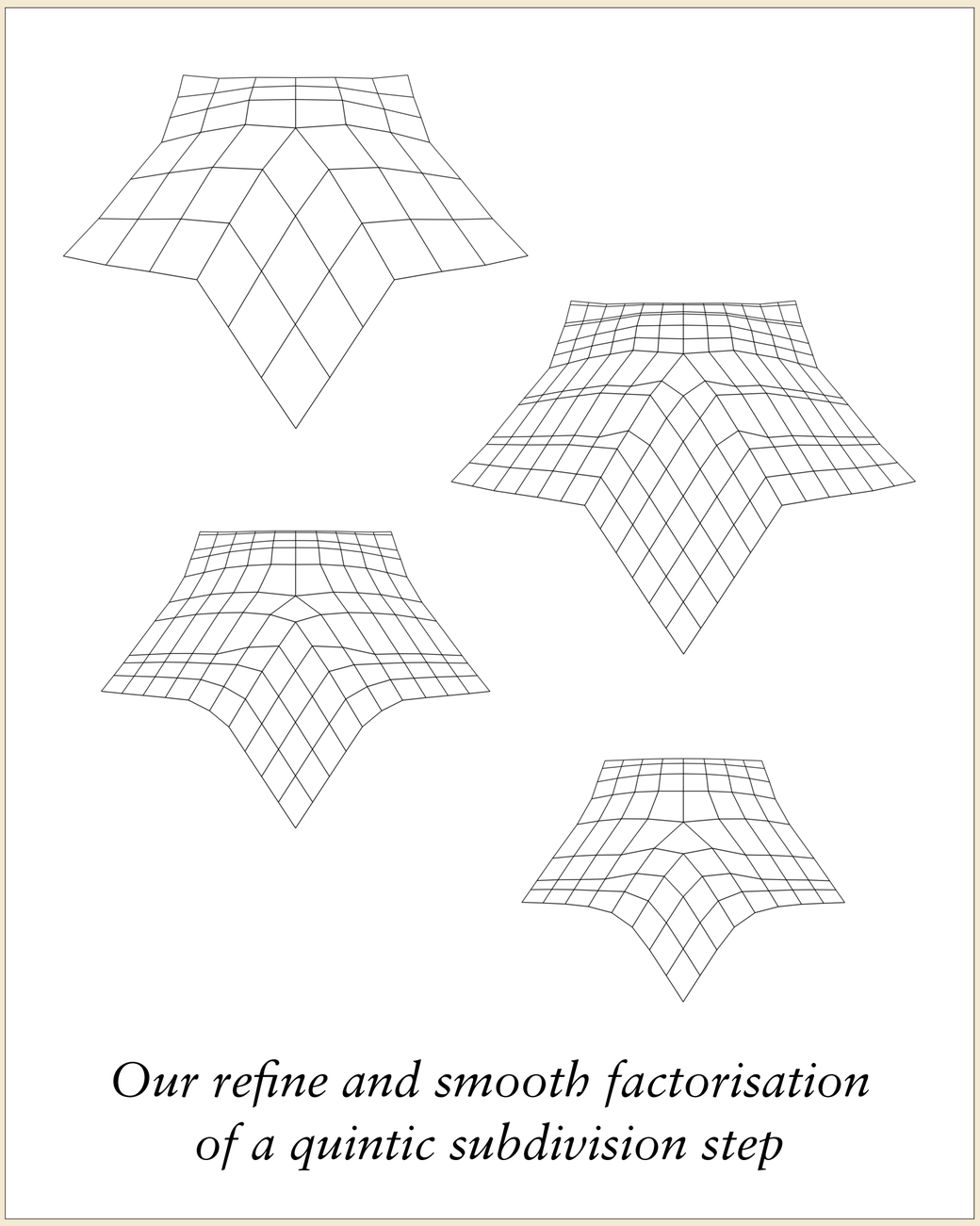
Of the two, NURBS offer greater power and control, and have long been the industry standard for engineering applications. Subdivision puts fewer constraints on the designer, and as a result has been increasingly used in modelling for animated films.

Our target is a NURBS-compatible subdivision scheme that combines the power of NURBS with the flexibility of subdivision. The scheme would incorporate NURBS surfaces as a special case, and would therefore make a strong argument for the benefits of subdivision in engineering applications.

Our approach

NURBS are well defined for any degree, but subdivision surfaces were originally just quadratic or cubic. Subdivision for general degree is a hard problem, as the structures used to calculate new points become larger as degree increases.





Our refine and smooth factorisation of a quintic subdivision step

General degree subdivision can be tackled, however, by using a ***refine and smooth*** construction to factorise the large structures into simpler steps. We have found a refine and smooth algorithm that allows us to handle subdivision of general degree NURBS surfaces.

Future work

The flexibility of subdivision comes from allowing irregularities in the surface. Our refine and smooth algorithm therefore needs to handle these irregularities, which are called ***extraordinary points***.

Our next step is making the generalisation to extraordinary points whilst guaranteeing the smoothness of the surface in irregular regions. The resulting scheme would be compatible with NURBS and immediately useful.