Geometry Instancing: Bézier Surface

Introduction
This demo is an implementation of the paper “Jörg Peters, Leif Kobbelt, The Platonic Spheroids”, which draws some sphere-like objects formed by multiple smoothly connected Bézier patches in GPU via geometry instancing.

About this paper
This paper describes a small family of polynomial surfaces that approximate the sphere and have the symmetry structure of Platonic polyhedra. These spheroids are constructed in a simple method: pick a polyhedron and its dual; associate each 3-valent vertex of the dual with a triangular patch of degree 3, or associate each 4-valent vertex with a quadrilateral patch of degree bi-2. The Bézier control points of spheroid patched are the face centroids, edge midpoints and scaled vertices of the dual.

Geometry Instancing
Thousands of triangles are created at the same position and each has a unique Instance ID. The vertices' position and surface normal is evaluated via De Casteljau’s algorithm in the vertex shader according to the Instance ID and control points sent to the GPU.

Octoid
Octoid is one of the spheroids introduced in this paper. It is formed by 8 triangular patches of degree 3 with 10 control points for each patch. The red points in the figure below are control points. The right one shows that if some control points are moved from their initial position, the surface will no longer be continuous at the patches' boundaries.

Tetroid
Tetroid is another spheroid which is formed by 4 triangular patches of degree 3 with 10 control points for each patch.