Edge Vertex relationships and EdgeBreaker optimization

Polygons are:
- Planar Graphs
- Connected. This means:
  - No holes
  - No faces with holes

V – Vertices
E – Edges
F – Faces

Polygon relationships:
- V = E
- V - E = 0
- F = 2

Then using induction:
F = F + 1
V = V + 2 and (V - E) + F = 2 since [(V+2) - (E + 3)] + F + 1 = 2.
E = E + 3.

Primitive Operations

Adding a vertex preserves V – E + F = 2
Adding an edge also preserves V – E + F = 2

Valence
- The valence of a vertex V is the number of incident edges.
- The valence of face F is the number of bounding vertices.
- For a t-mesh the average vertex valence is approximately 6

Characterizing a mesh in terms of vertex valence K allows identification of meshes in terms of the primitives used to build the mesh.
So transforming \( V-E+F = 2 \) to an equation using \((V, F, K)\):

\[ K = 3. \text{ Edge uses } = 6. \]
So \( \text{Sum } K = 2E. \)

Edges are used by vertices \( KV \). Each edge is used twice \( 2E. \)

\[ 2E = KV \]
\[ E = (K/2)V \]

\[ V - (K/2)V + F = 2 \]
\[ (1 - (K/2))V + F = 2 \]
\[ ((2 - (K/2))/2)V + F = 2. \]

If a T-Mesh is assumed, then:

Edge uses is \( 3T \), and each edge is used twice \( 2E \) so:

\[ 2E = 3T \]
\[ E = (3/2)T \]
\[ V-(3/2)T + T = 2 \]
\[ 2V-T=4 \]
\[ T=2V-4 \]

**Improving Edge Breaker:**
- Certain combinations of letters are not possible. This can be used as an optimization.
- Letters with offset encoding can be used to replace runs.
- S triangles can be reduced.
- Geometry can be used to predict encoding