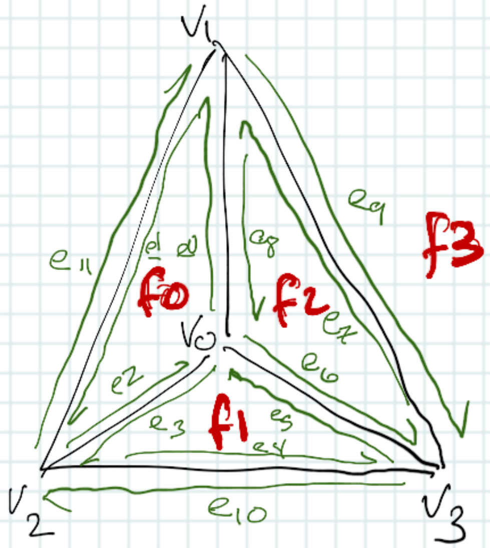
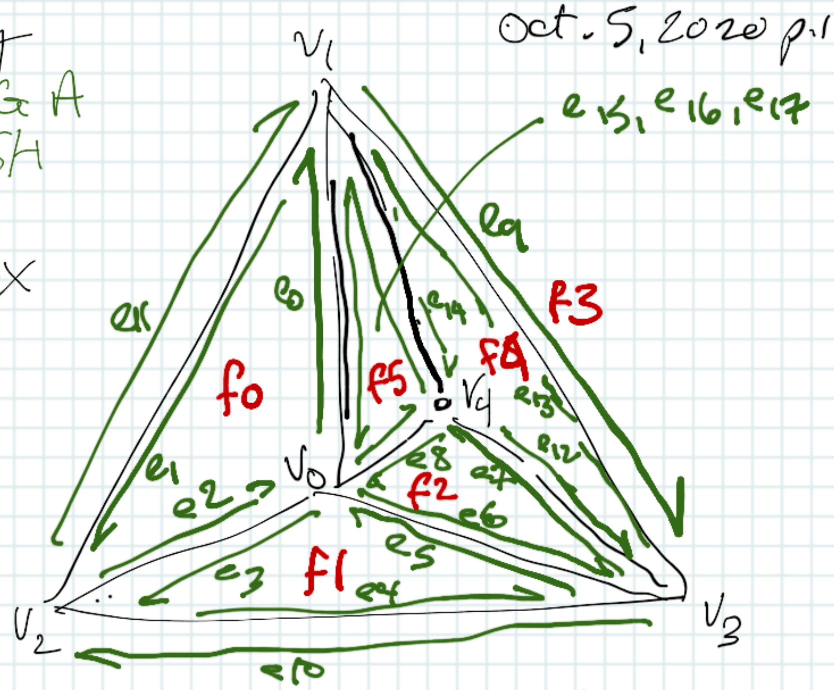


EDITING A MESH

ADD A VERTEX



Vertex				FDE	
v0 ✓	-1	-1	-1	v0	e0 ✓
v1 ✓	1	-1	1	v1	e1 ✓
v2 ✓	-1	1	1	v2	e2 ✓
v3 ✓	1	1	-1	v3	e5 ✓
v4 ✓	?	?	?	v4	e8

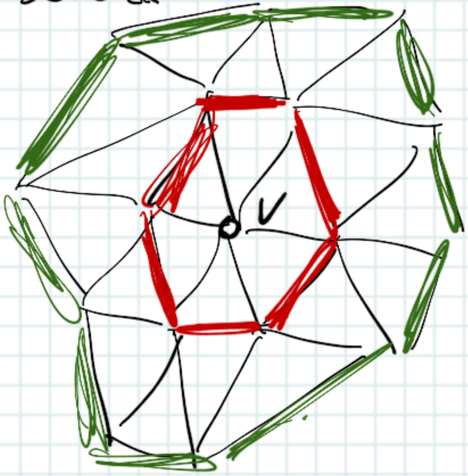
	Face		OtherHalf	
f0	e0	v0 ✓	e0	~~e8~~ e16
	e1	v1 ✓	e1	e11 ✓
	e2	v2 ✓	e2	~~e3~~ ✓ e15
f1	e3	v0 ✓	e3	~~e2~~ ✓ e14
	e4	v4 ✓	e4	e10 ✓
	e5	v1 ✓	e5	e6 ✓
f2	e6	v0	e6	e5 ✓
	e7	v3	e7	~~e9~~ e12
	e8	~~v1~~ v4	e8	~~e0~~ e17
f3	e9	v1 ✓	e9	e7 e13
	e10	v3 ✓	e10	e4 ✓
	e11	v2 ✓	e11	e1 ✓
f4	e12	v4	e12	e7
	e13	v3	e13	e9
	e14	v1	e14	~~e15~~ e3
f5	e15	v0	e15	~~e14~~ e2
	e16	v2	e16	e0
	e17	v3	e17	e8

UPDATE COST:

$O(1)$

DELETE VERTEX 2:
KEEP FACE 0 & UPDATE
FACE 1,3 - DELETE
SWAP 1 with 5
3 with 4
delete 4,5

Our edits are local – they only affect a face or vertex and it's neighbours.



adjacent vertices at distance 1

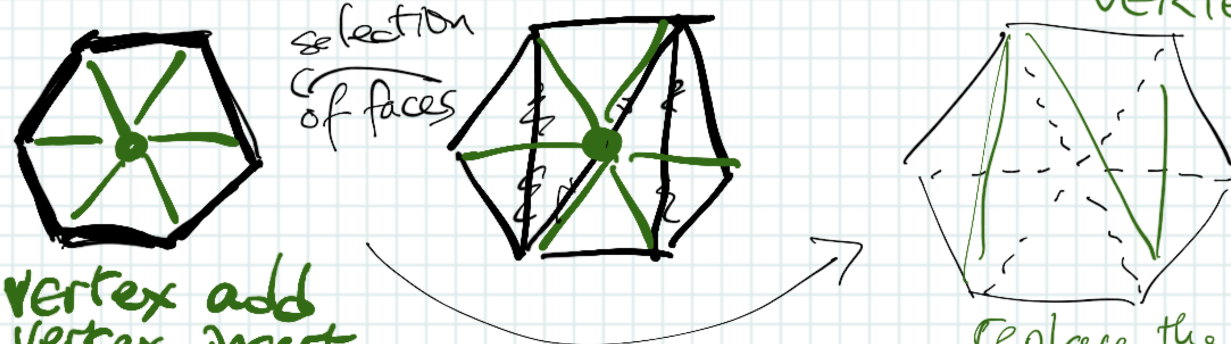
The 1-RING

$N_1(v)$

OPERATIONS:

INVERSE:

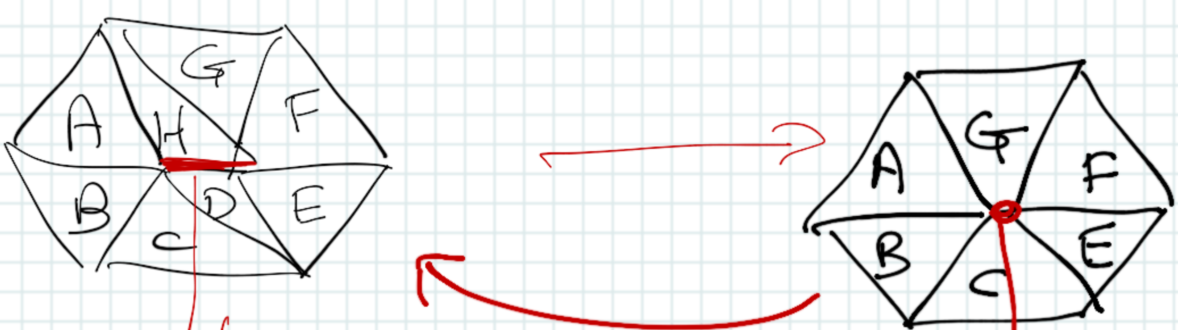
VERTEX DELETE



vertex add
vertex insert

replace the vertex & it's 1-ring with faces

adding vertices to faces tends to increase degree of old vertices (bad)

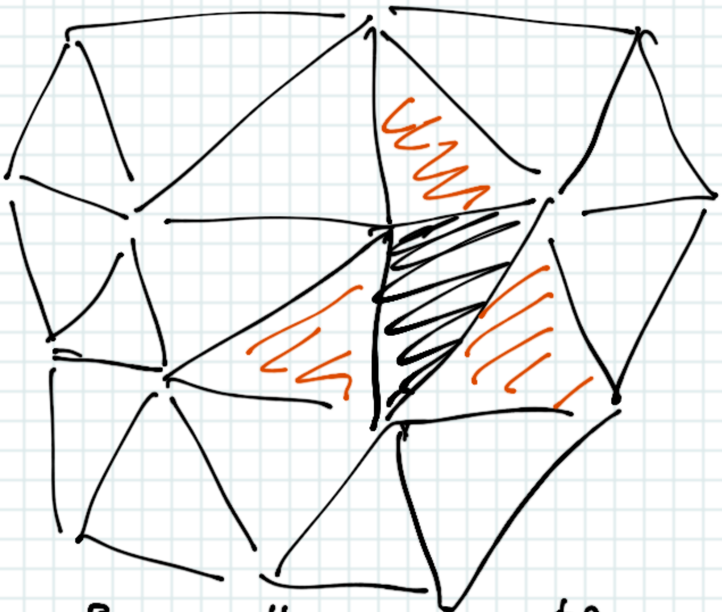


edge collapse / deletion / removal

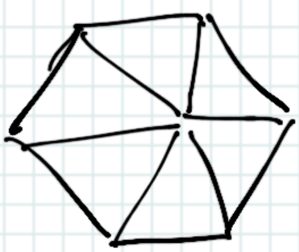
vertex split

pick a vertex

2 choices: vertex collapses to other
they meet in the middle

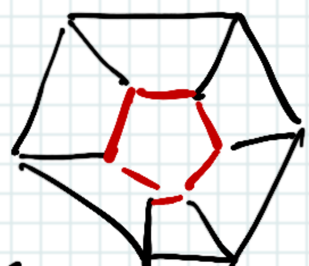


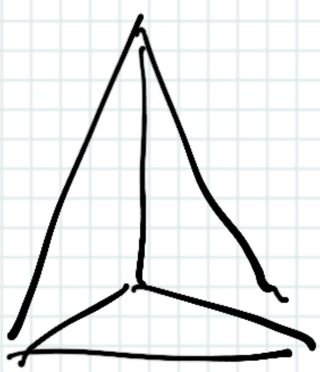
face collapse - vertices combine it doesn't reverse



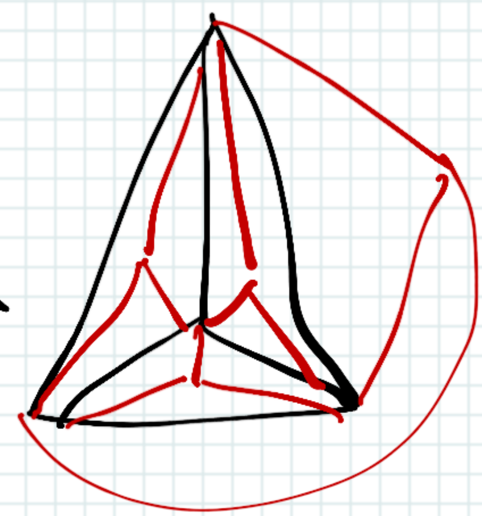
truncation

stellation

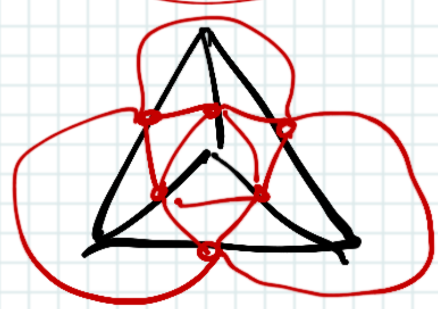


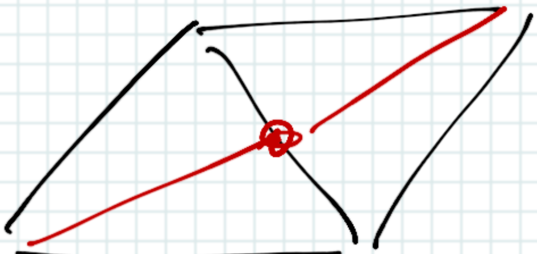


barycentric subdivision



edge subdivision



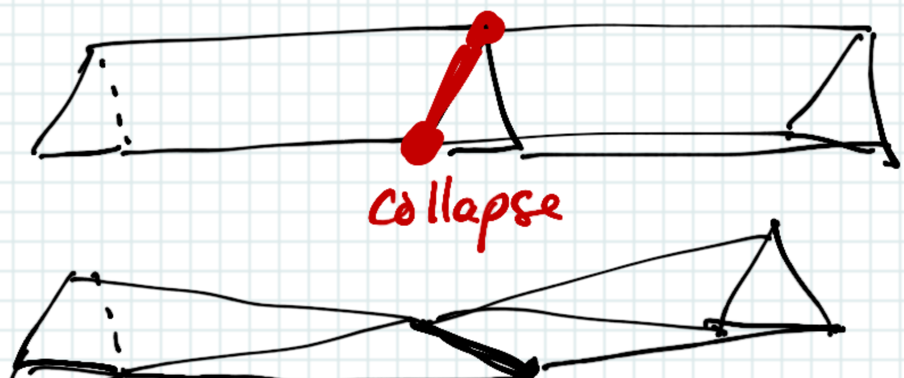


edge split

After an operation, is the mesh still manifold?

adding is usually OK

deleting ?



An Eulerian operator is one that preserves the manifold

vertex collapse is usually safe

Solution 1: test before you collapse

Solution 2: prove it is safe

Theorem: an edge collapse of (p,q) is Eulerian iff

a) edge pq is on the boundary of the mesh iff p & q are on the boundary

b) $\forall r \in N_1(p,q), \exists \triangle pqr$