SCDL1991 TRIANGULATION OF SURFACES

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Figure 8 – World map in a torus

Research Question

Given a fixed type of surface and number of triangles, how many different ways can a closed orientable surface be triangulated?

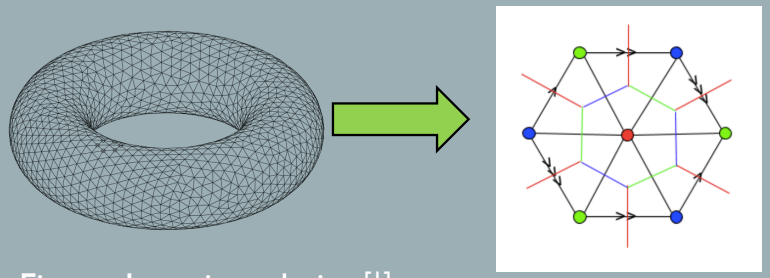


Figure 1 – triangulation[1]

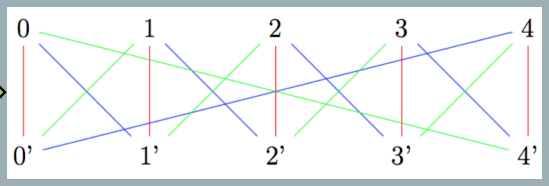
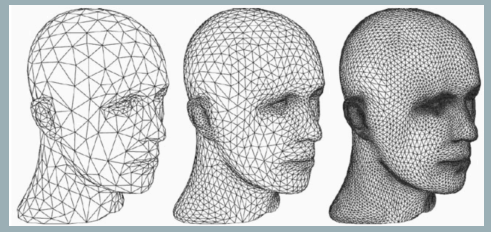
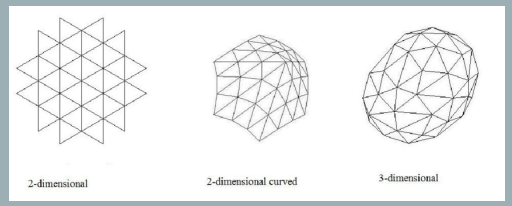


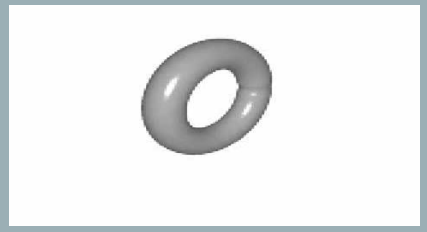
Figure 2 and 3 – Dual graph rainbow colouring and Graph encoded manifold (gem)



Figures 4 – Tessellation[2] (Applications)



Figures 5 – Modelling an evolving space-time (Application)



Figures 6 – Homeomorphism[3]

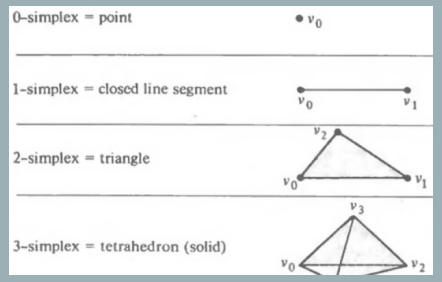
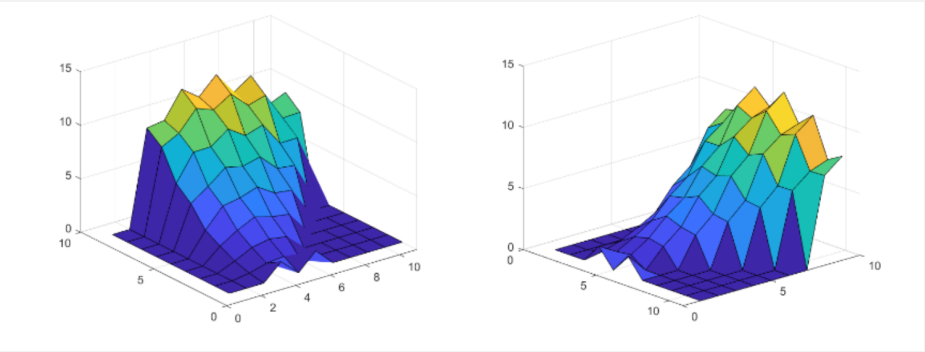


Figure 7 – Simplicial complexes

	v (number of vertices)								
n	3	4	5	6	7	8	9	10	11
1	0								
2		1							
3	1		5						
4		10		14					
5	8		70		42				
6		168		420		132			
7	180		2121		2310		429		
8		6088		20790		12012		1430	
9	8064		115720		174174		60060		4862
10									

Results Table



Surface plot of Valid Permutations

Data Trends

-If v - n is odd, there are no valid permutations

-If v > n + 2, there are no valid permutations

-The diagonals of the table grows exponentially with v

-The vertical lines of the table grows super-exponentially with v

Therefore, the maximum number in each row occur within the set of nonzero entries in that row

Limitations

-If v takes high case values (v = 6), the system breaks down

-Algorithms are not efficient enough for higher cycle number of μ

-Over-counting issues for permutations

Therefore, it is recommended to eliminate over-counting issues by studying the system symmetries, and to reproduce codes that allows for multiple structures of μ permutations

BIBLIOGRAPHY

[1] Torus: Triangulated by the Marching Method. https://en.wikipedia.org/wiki/Surface_triangulation#/media/File:Torus-triang.svg Wikipedia, 2015.

[2] M. Niener, B. Keinert, M. Fisher, M. Stamminger, C. Loop, and H. Sch ̈afer. Real-time rendering techniques withhardware tessellation.Comput. Graph. Forum, 35(1):113–137, February 2016.

[3] Jim Fowler, Coffee Cup Donut. https://www.youtube.com/watch?v=4iHjt2Ovqag&feature=youtu.be 2013, Youtube.

[4] Jonathan Spreer, Max Tobin, Steven Condell, and Taylor Ruber. Graph encoded manifolds. Technical report, The University of Sydney, 2020.