

How Curving Does Give Strength To a Material Structure?

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M1 Maths

Abstract

Have you ever noticed that just folding a pizza, you can avoid your T-shirt from being stained ?
Do you know that this smart trick just lays on a remarkable mathematical principle?

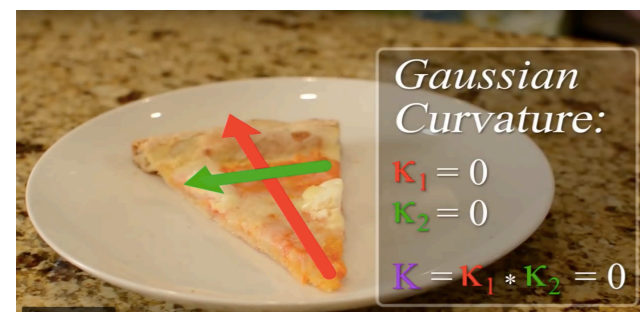
Presentation of the theorem is followed by some practical examples and finally, consequences of this principle in our real life are highlighted.

I. Gauss curvature and theorem

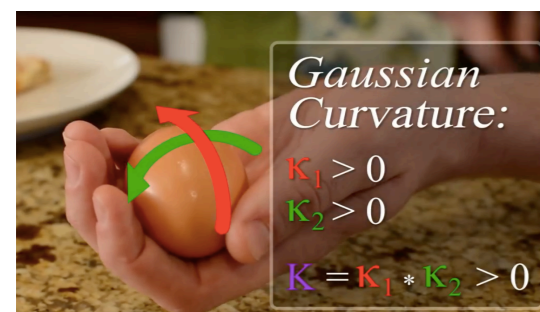


$$K = K_1 \times K_2$$

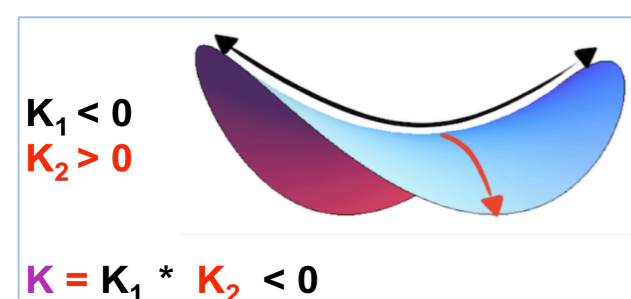
Curvature definition at a point on the surface according to Gauss.



➤ ZERO CURVATURE



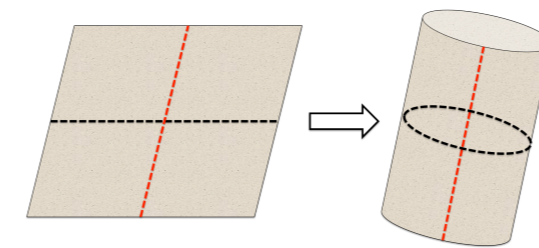
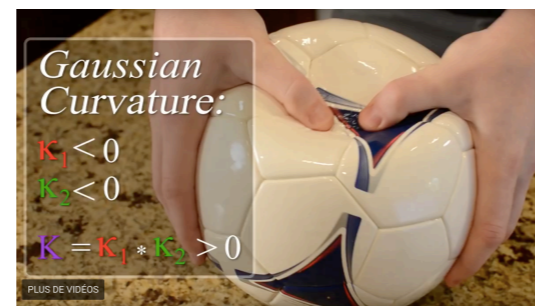
➤ POSITIVE CURVATURE



➤ NEGATIVE CURVATURE

◆ Gauss "Remarkable principle"

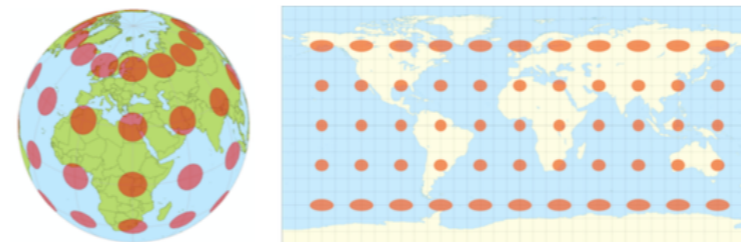
K remains constant after an isometric deformation of the surface



II. Gauss principle consequences

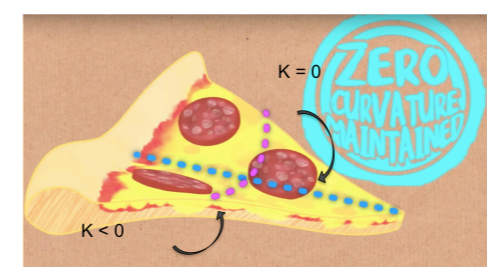
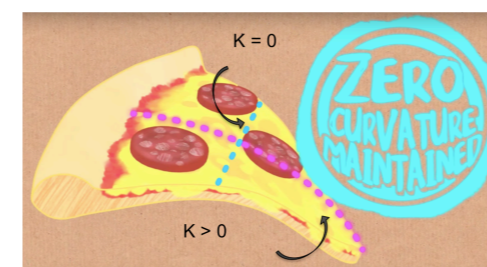
A. A sphere is not a plan

➤ MAPPING

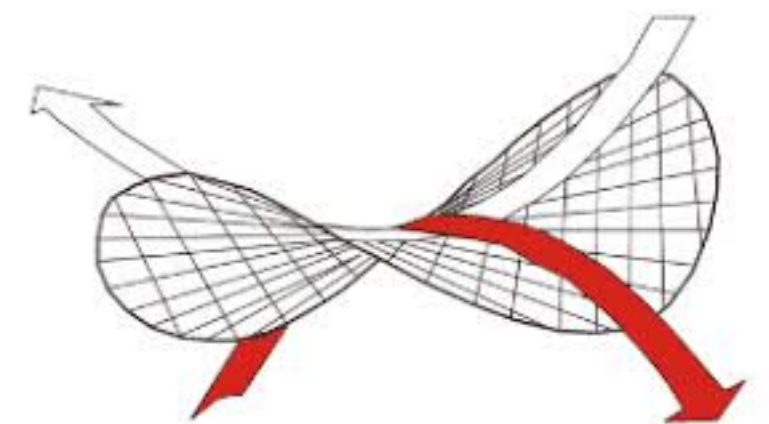


B. Curvature and strength

➤ SLICE OF PIZZA



➤ PRINGLES



Mechanic Features:

- Compression
- tension

➤ CORRUGATED MATERIALS



Benefits of corrugated webs:

- Better elasticity
- Bending resistance

III. Conclusion

- Although former civilizations had already understood the link between curvature and structure strength regarding external efforts, Gauss seems to be the first one to have formalized the concept of curvature with his definition.
- Moreover, what is "remarkable" is that with his model, he established a simple theorem, which explains clearly why curvature is a key point in mechanical properties in general.
- This theorem is well known by architects.



REFERENCES

"How a 19th Century Math Genius Taught Us the Best Way to Hold a Pizza Slice," *WIRED*. [Online]. Available: <https://www.wired.com/2014/09/curvature-and-strength-empzeal/>