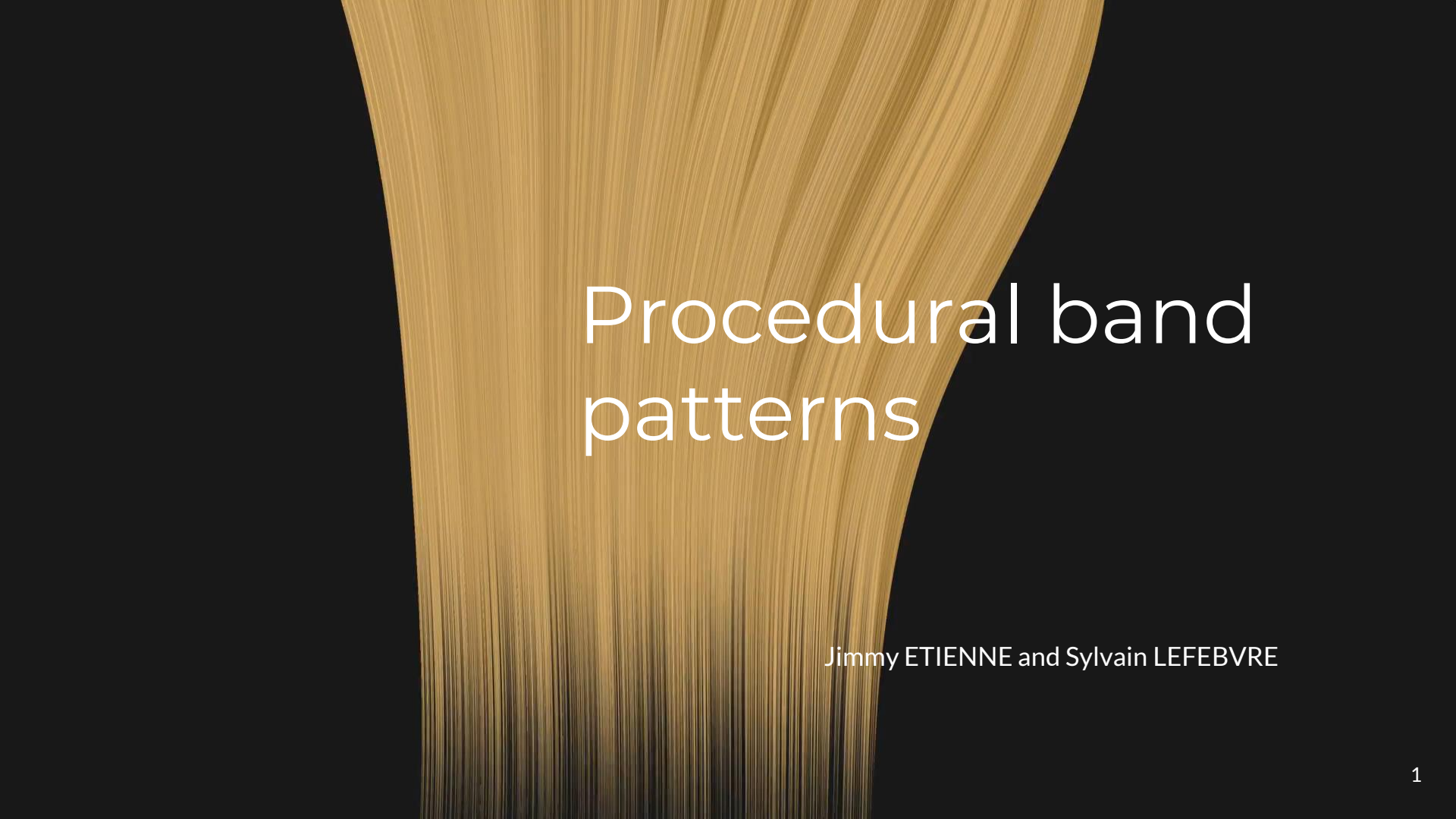
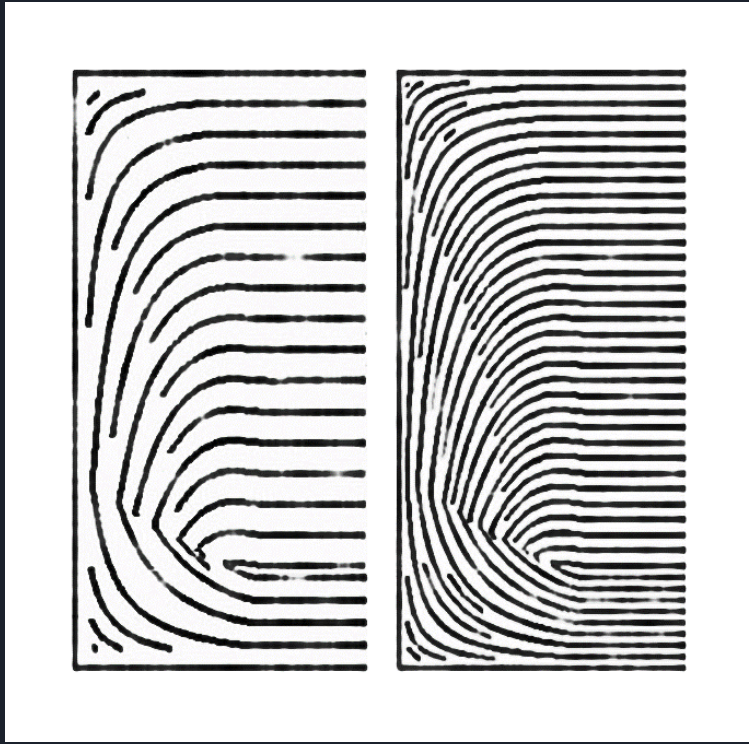


Procedural band patterns

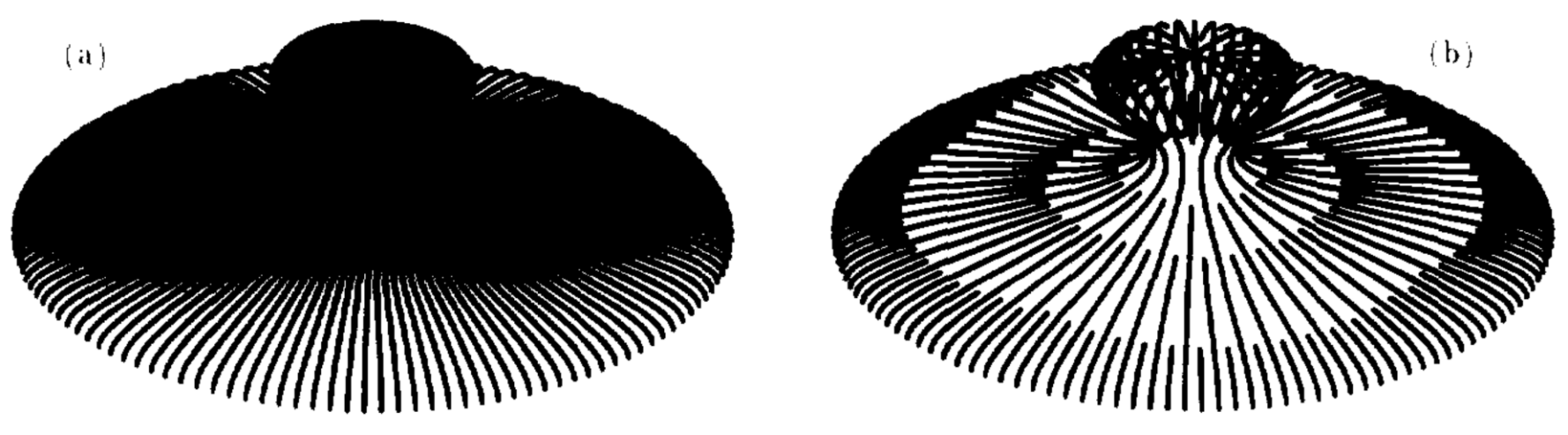
Jimmy ETIENNE and Sylvain LEFEBVRE

Context



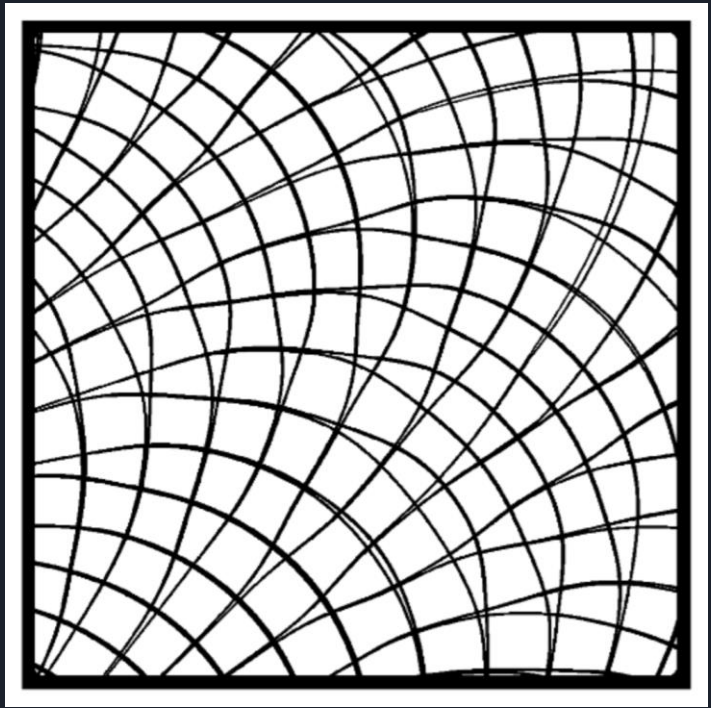
Eden, O., Elber, G., & Ungarish, M. Adaptive Streamlines Coverage Toward Visualization and Animation of Two-dimensional Unsteady Flows.

Context



Elber, G., & Cohen, E. (1996). Adaptive isocurve-based rendering for freeform surfaces. *ACM Transactions on Graphics (TOG)*, *15*(3), 249-263.

Context



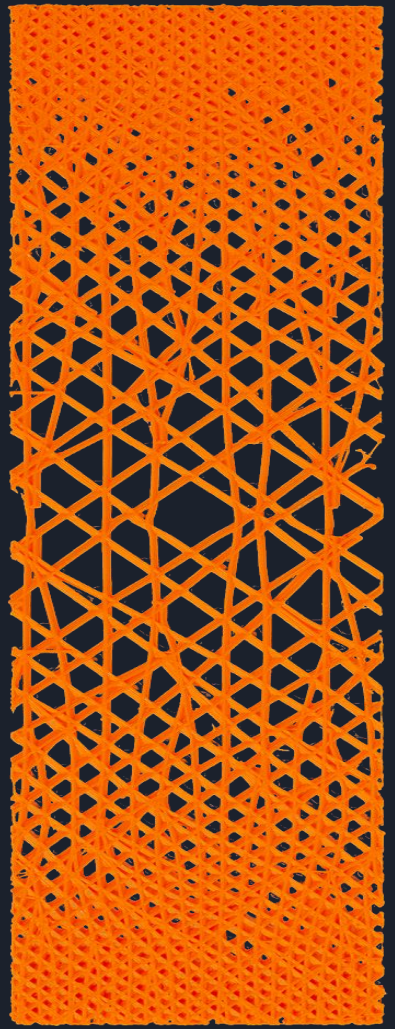
Groen, J. P., Wu, J., & Sigmund, O. (2019). Homogenization-based stiffness optimization and projection of 2D coated structures with orthotropic infill. *Computer Methods in Applied Mechanics and Engineering*, *349*, 722-742.

Our objective

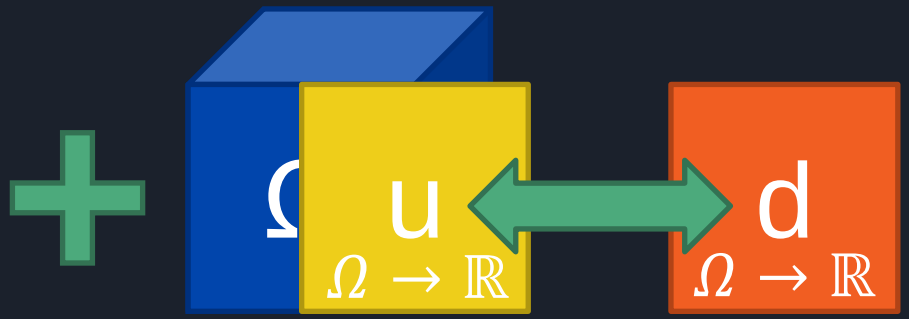
Proceduraly create parallel bands

Orientation control

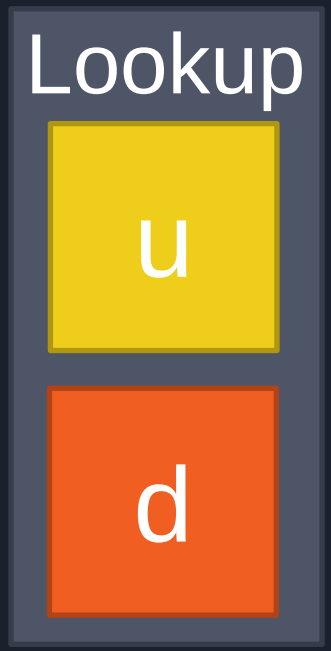
Better density control

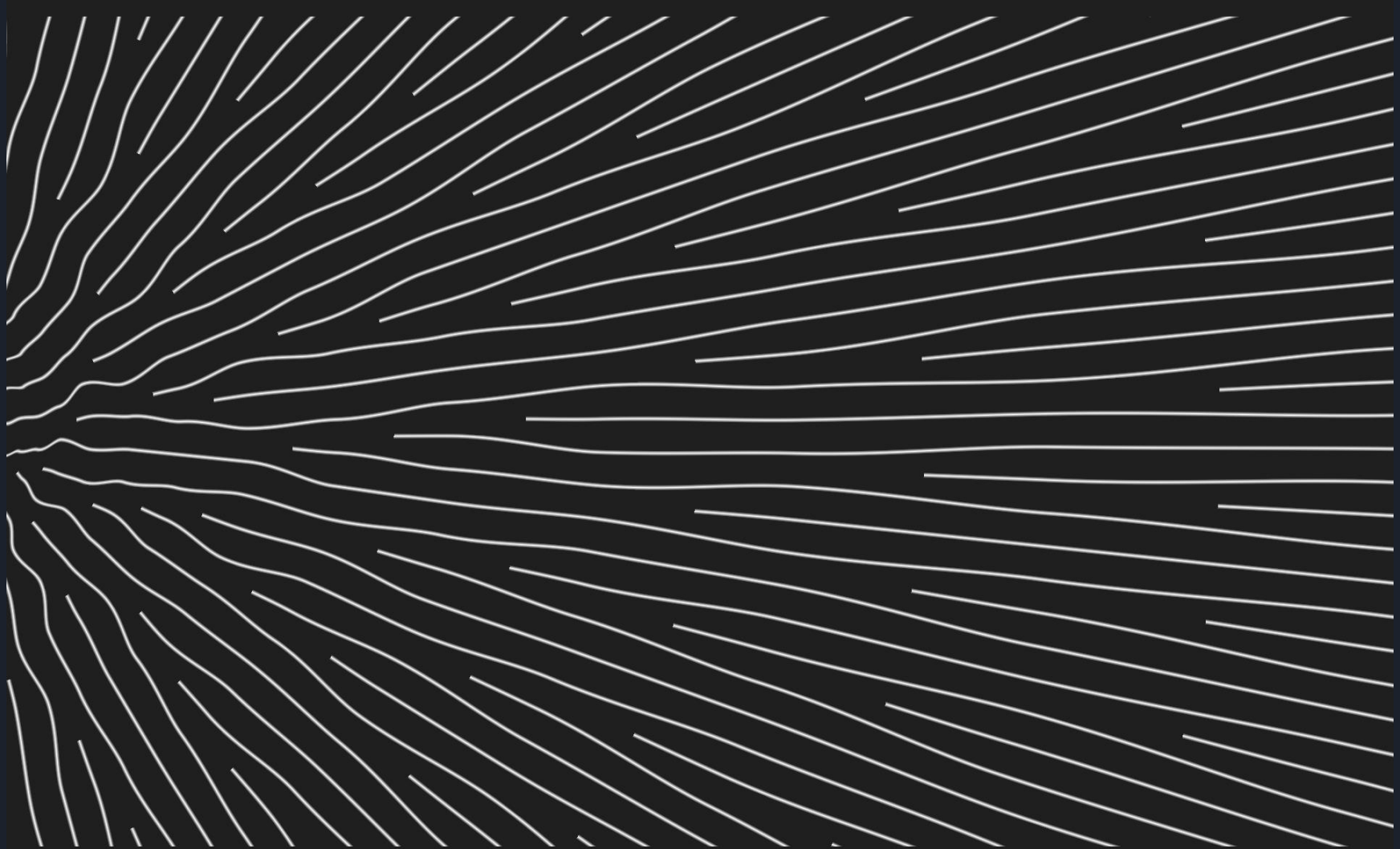


Overview - Inputs

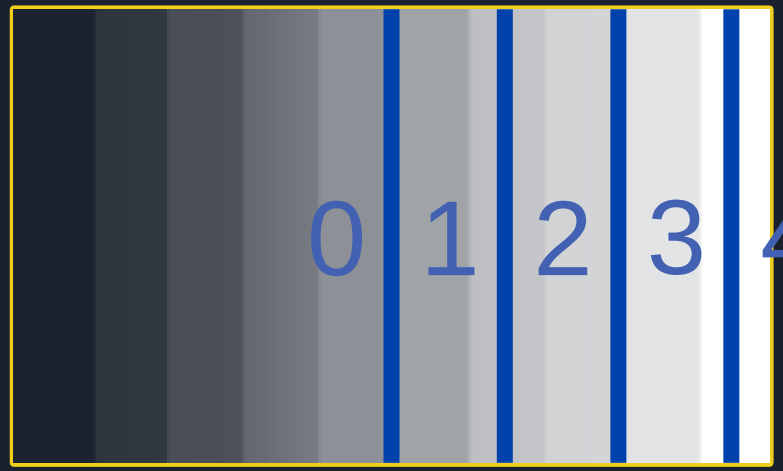


Overview - Output



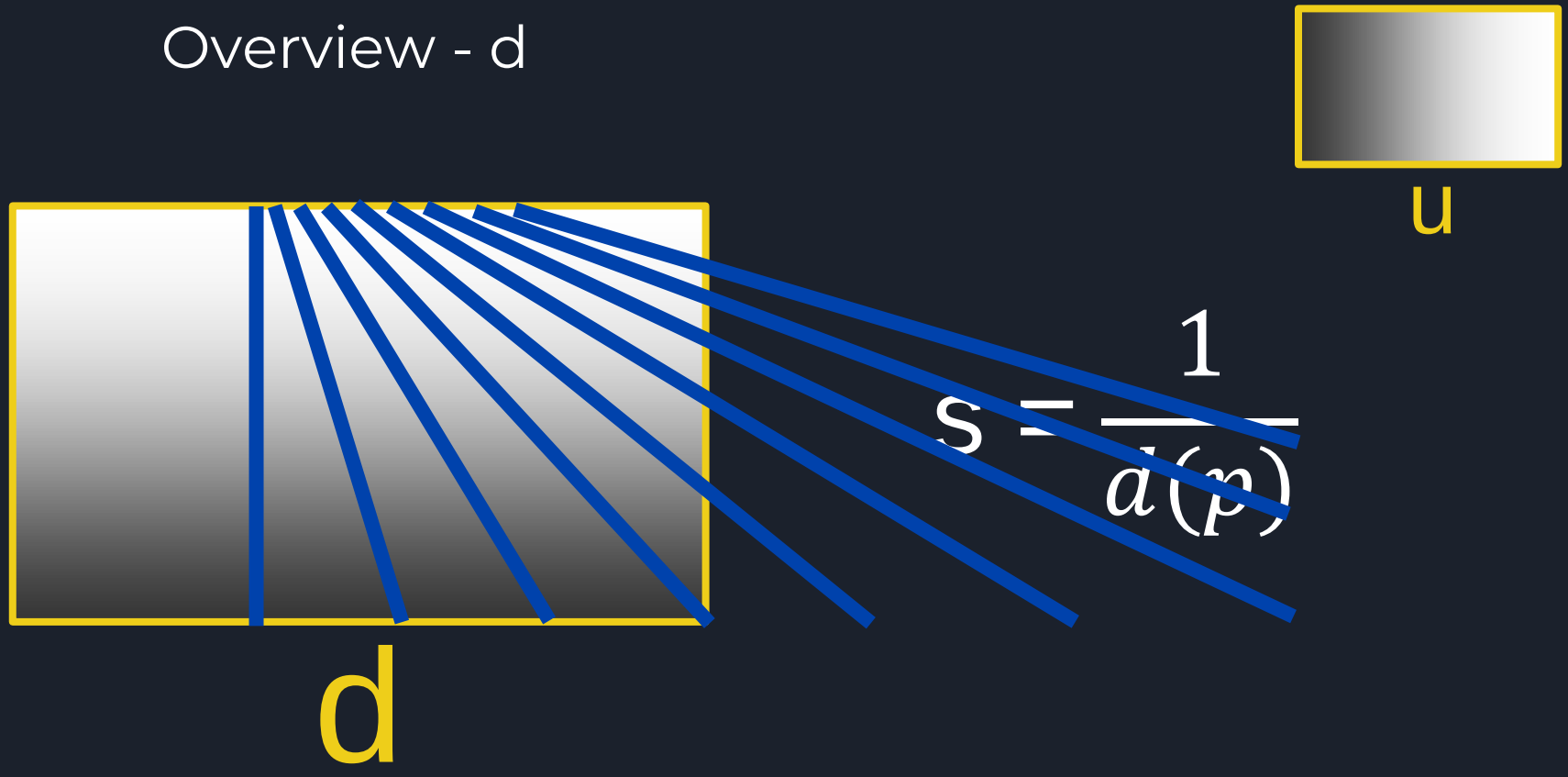


Overview - u

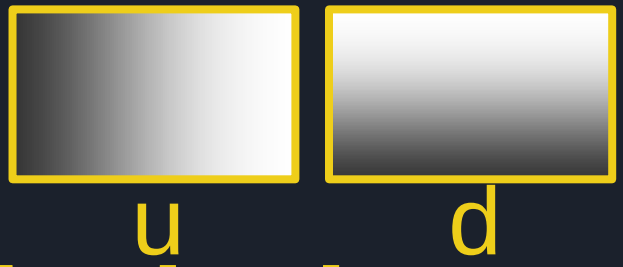


$$id = \left\lfloor \frac{u(p)}{s} \right\rfloor$$

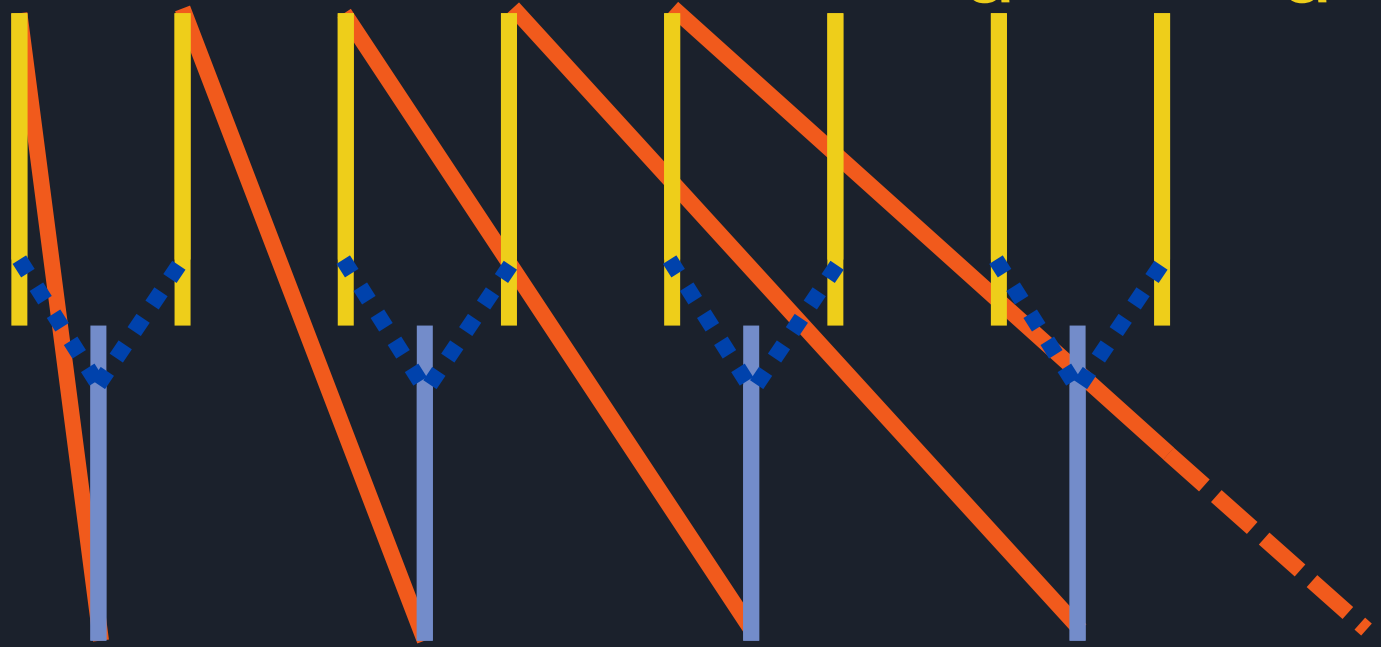
Overview - d



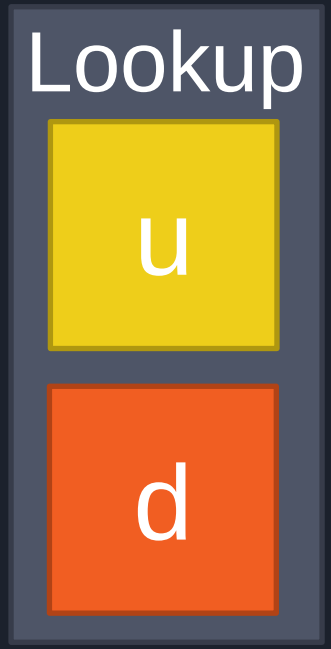
Overview - level



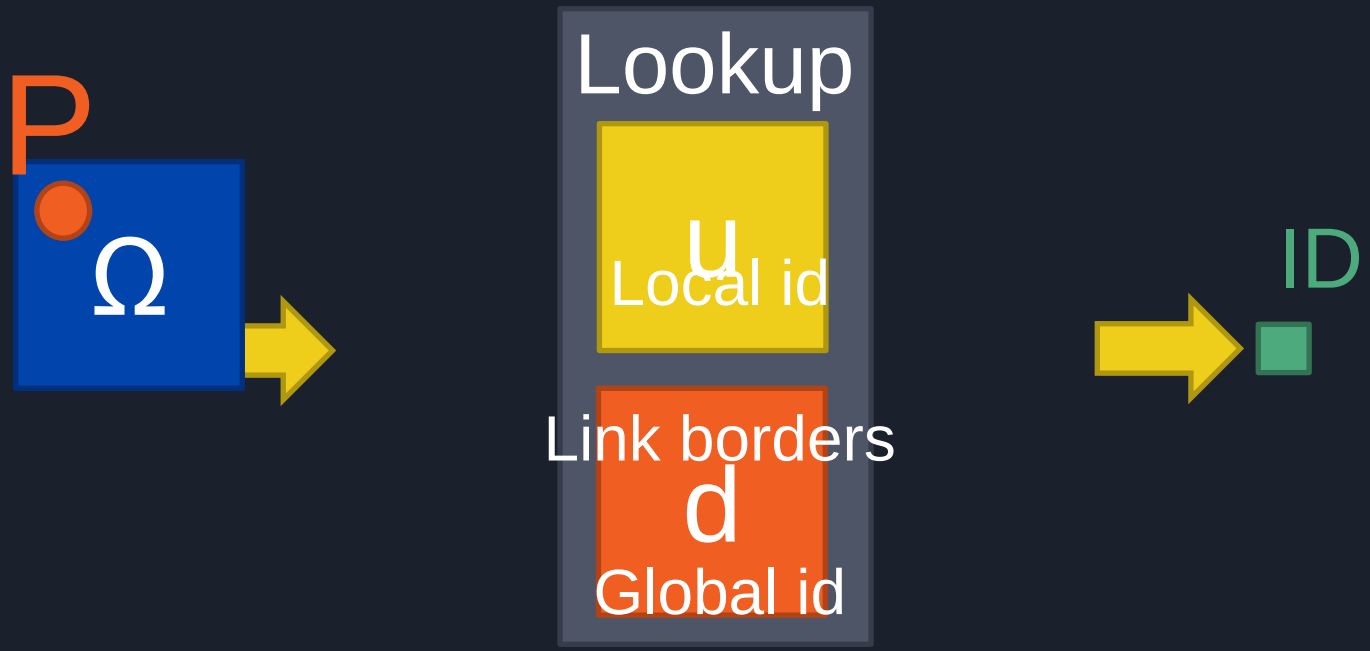
$qd(p)$



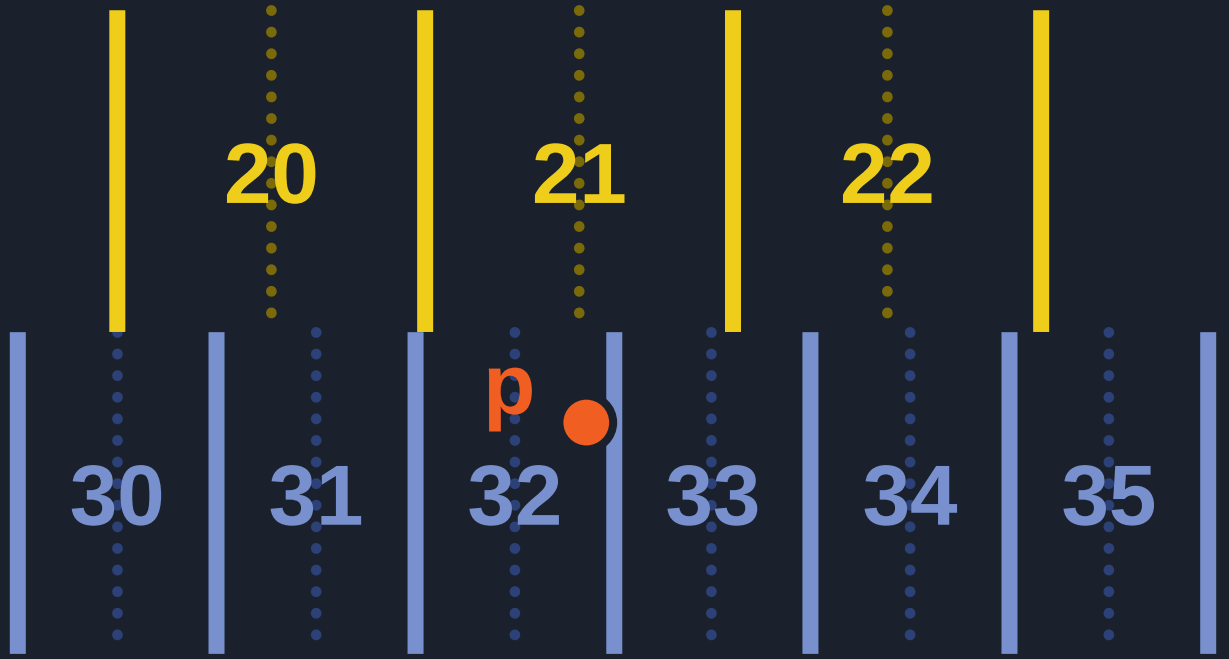
Finding the id



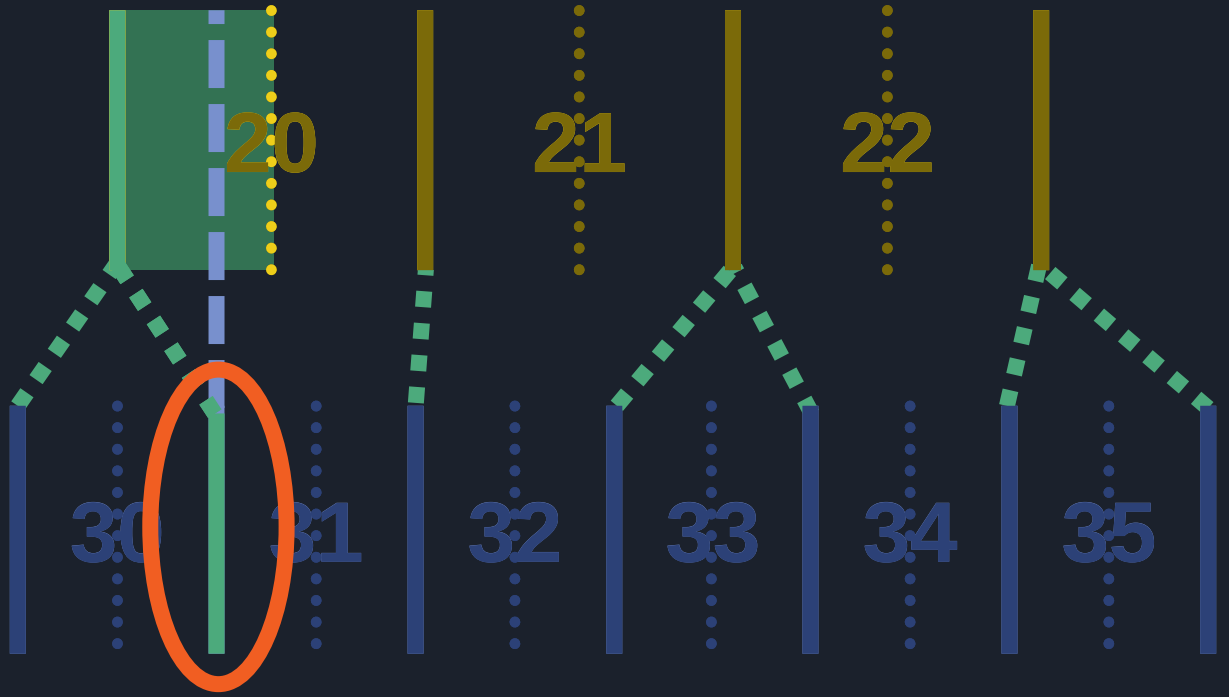
Finding the id



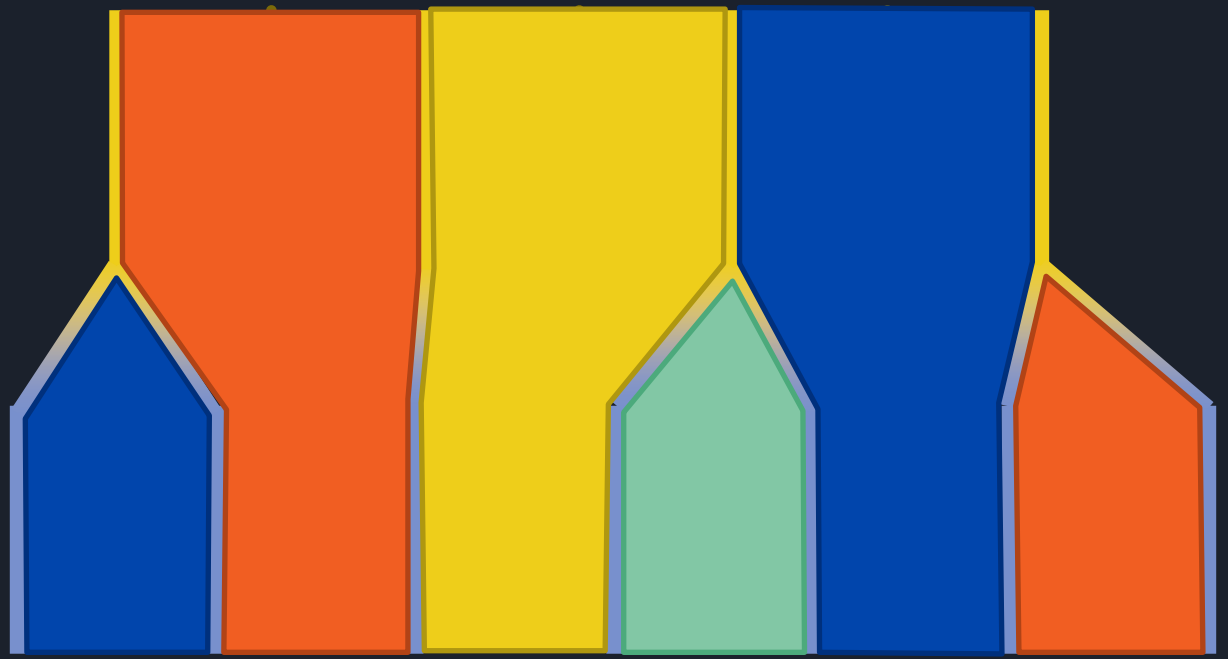
Local id $= \left\lfloor \frac{u(p)}{qd(p)} \right\rfloor$

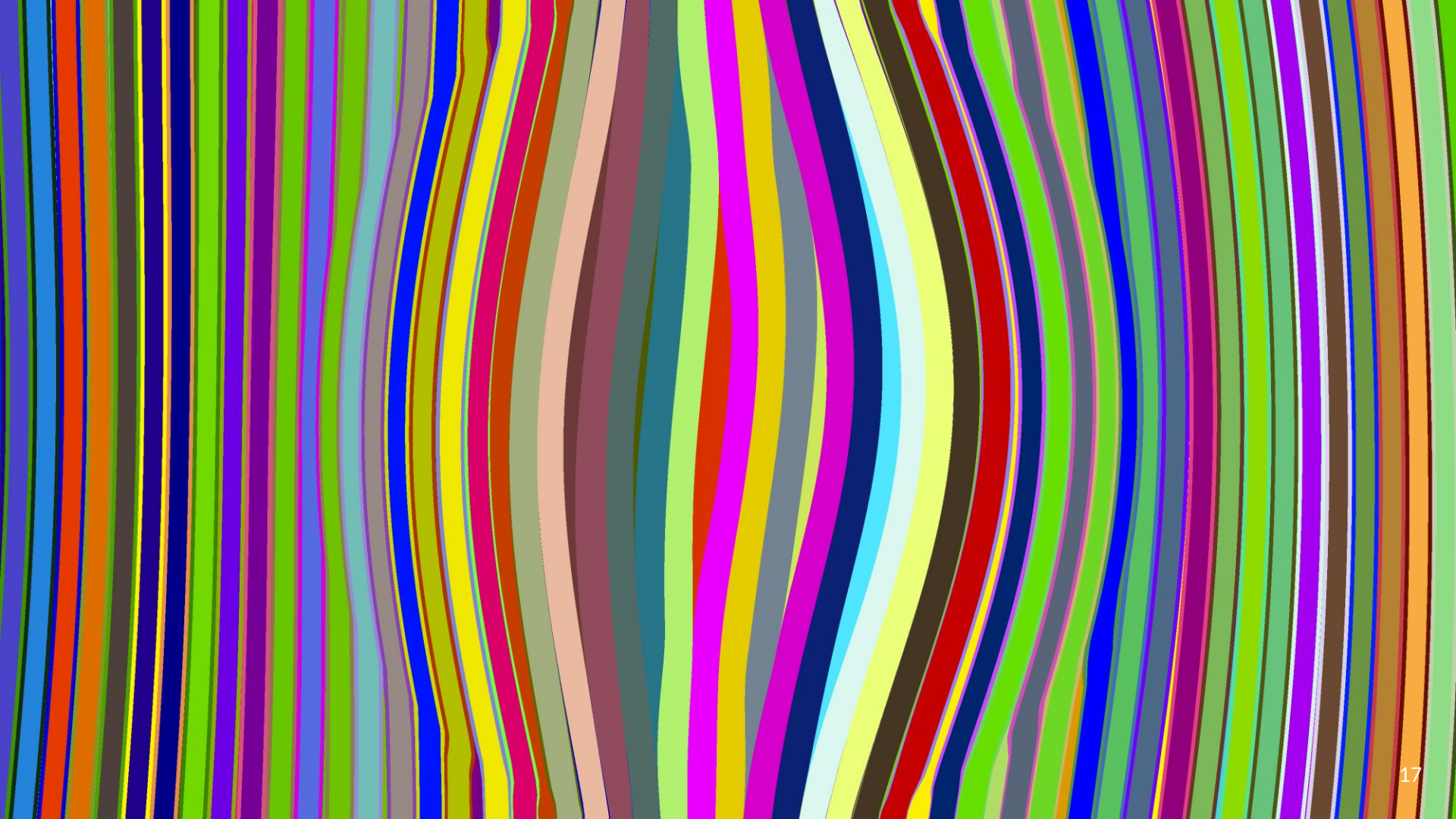


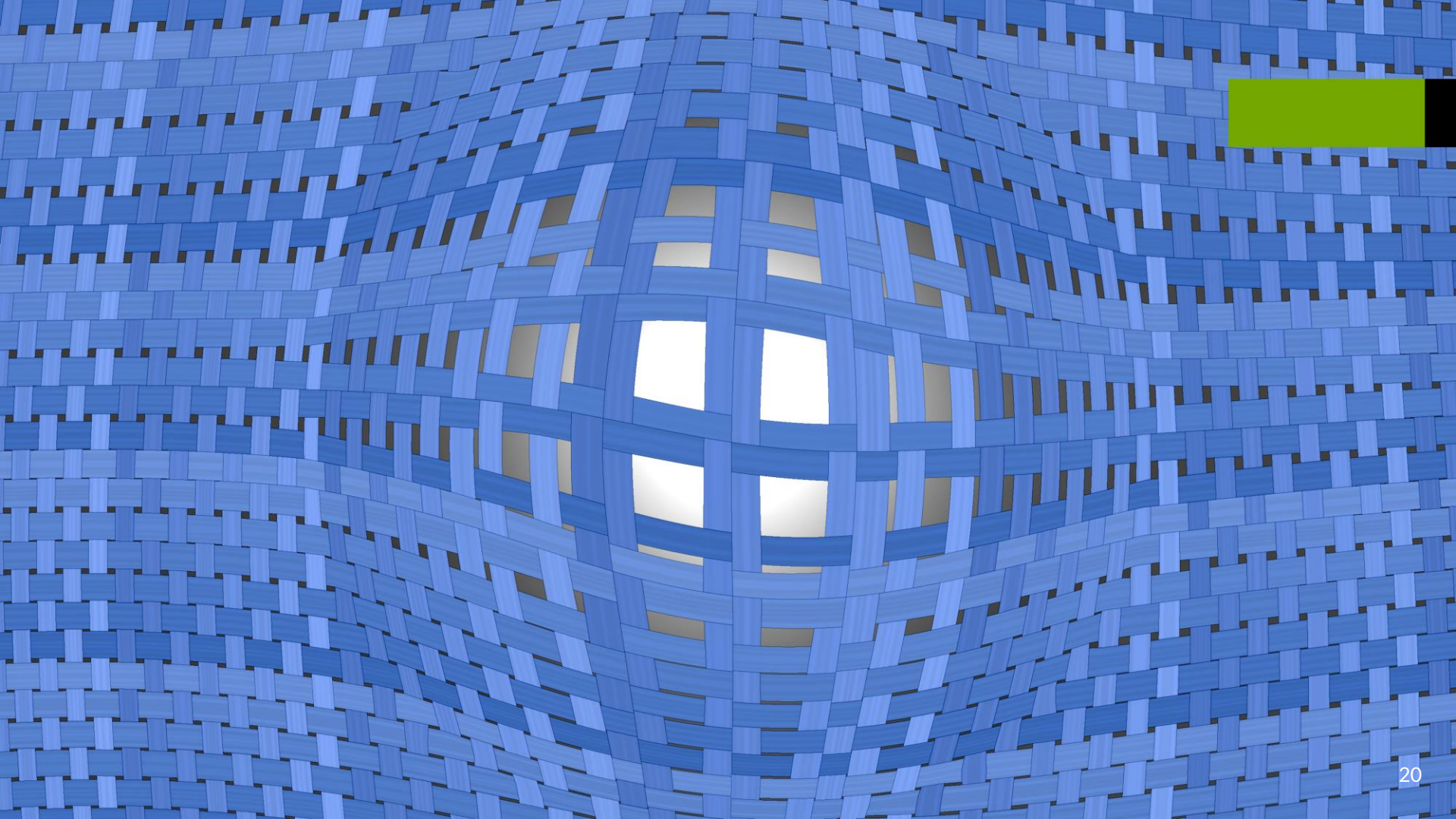
Link borders



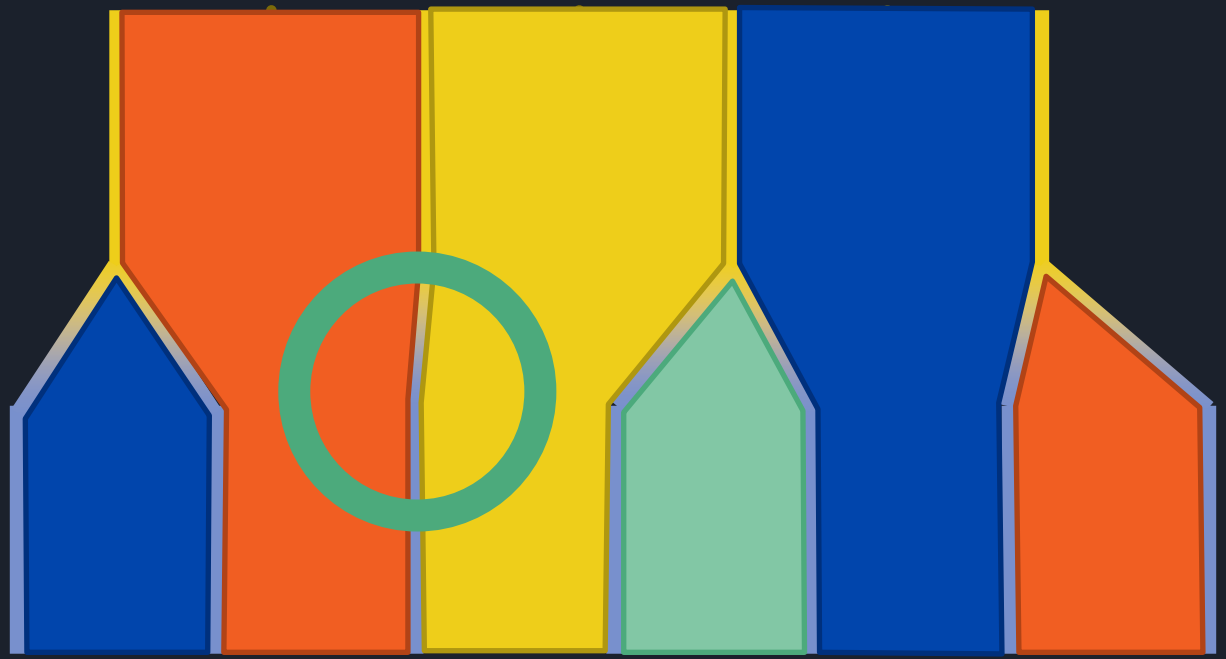
Global id







Global id



Subdivision level

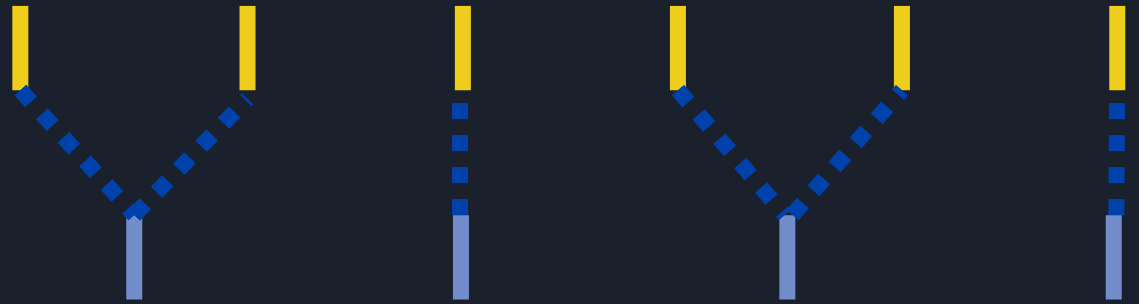
$$1 < step \leq 2$$

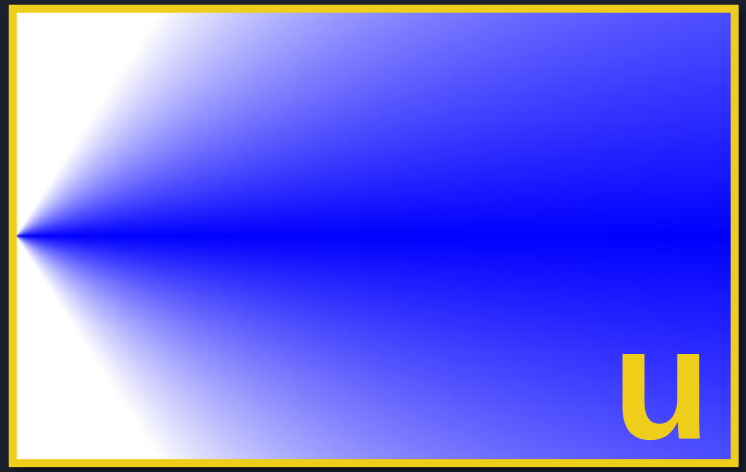
$$step = \begin{matrix} 2 \\ \cancel{2} \\ 1 \end{matrix}$$

Subdivision level

$$1 < step \leq 2$$

$$step = \frac{3}{2}$$




u


d


step = 2


step = 1,1

Conclusion

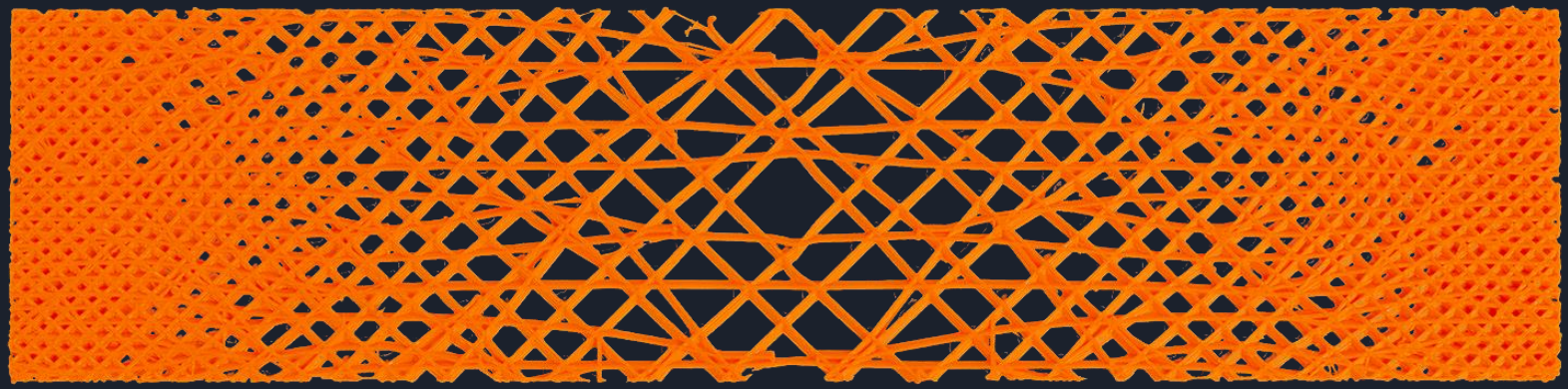
Simple

Procédural

Polyvalent

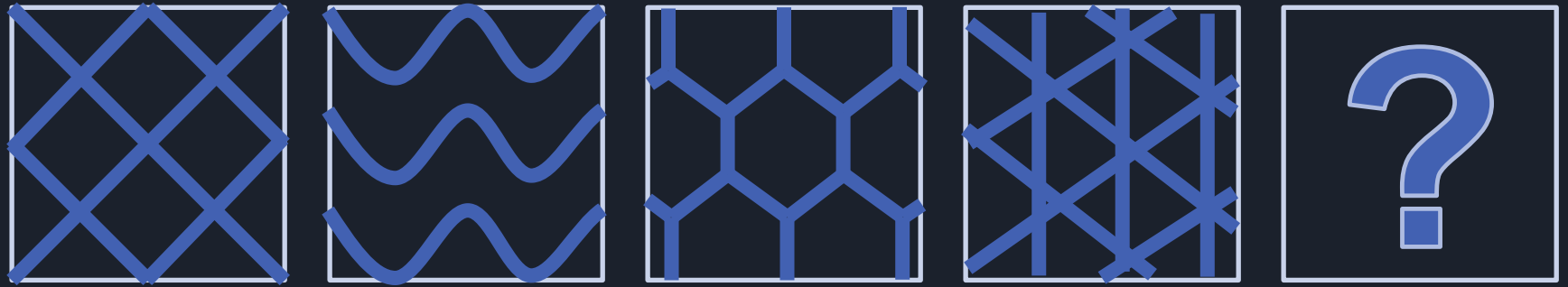
Overview

Our infill



Initial goal

Create a controllable infills for 3D printing



Objectives

Cover a parametric domain with “evenly” spaced paths

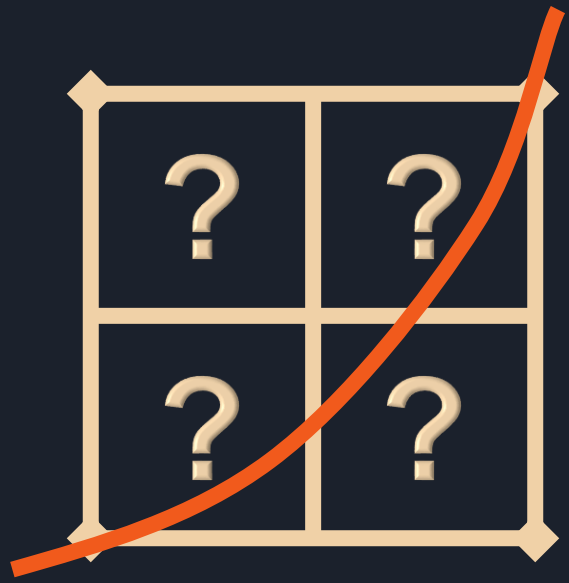
Have a good control over density and orientation

Compute the paths as fast as possible

Extracting paths procedurally

Is complicated

Is unstable

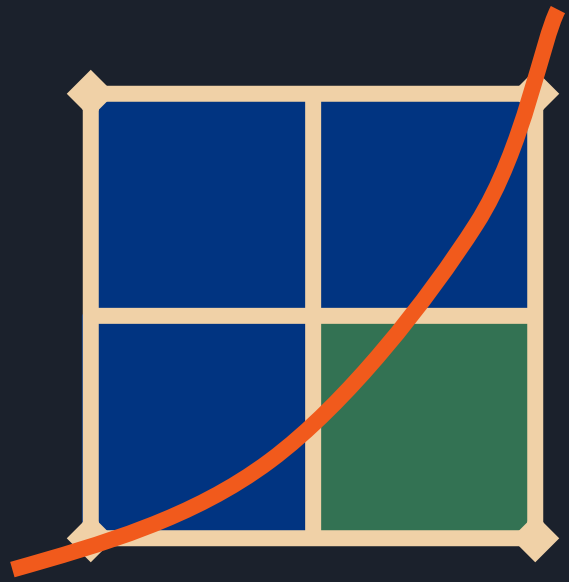


3-SAT is not our problem

Creates colored cells from shaders

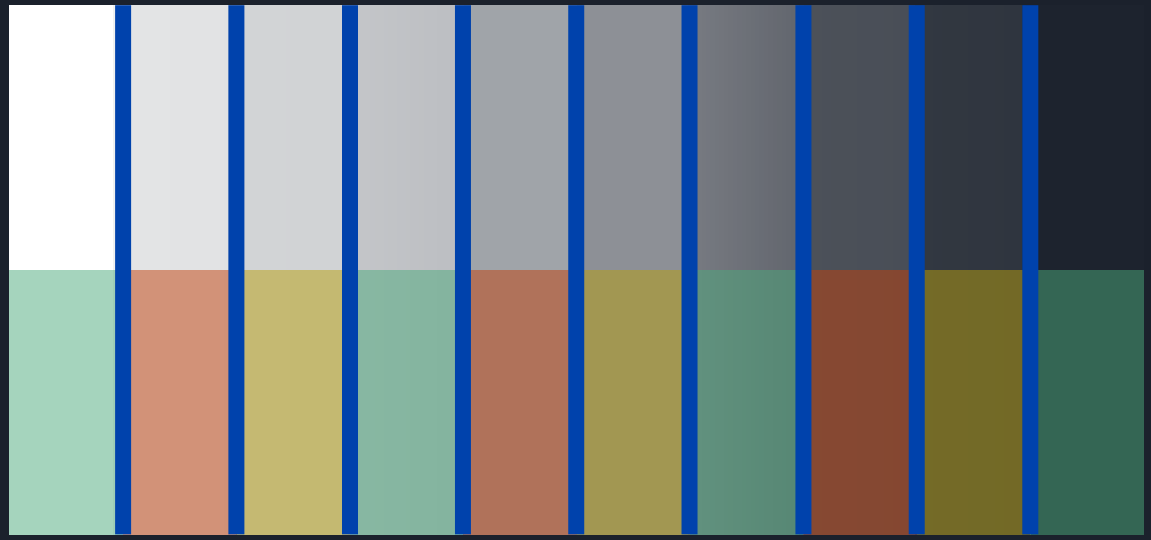
Extracts the frontier between cells

Generates the paths



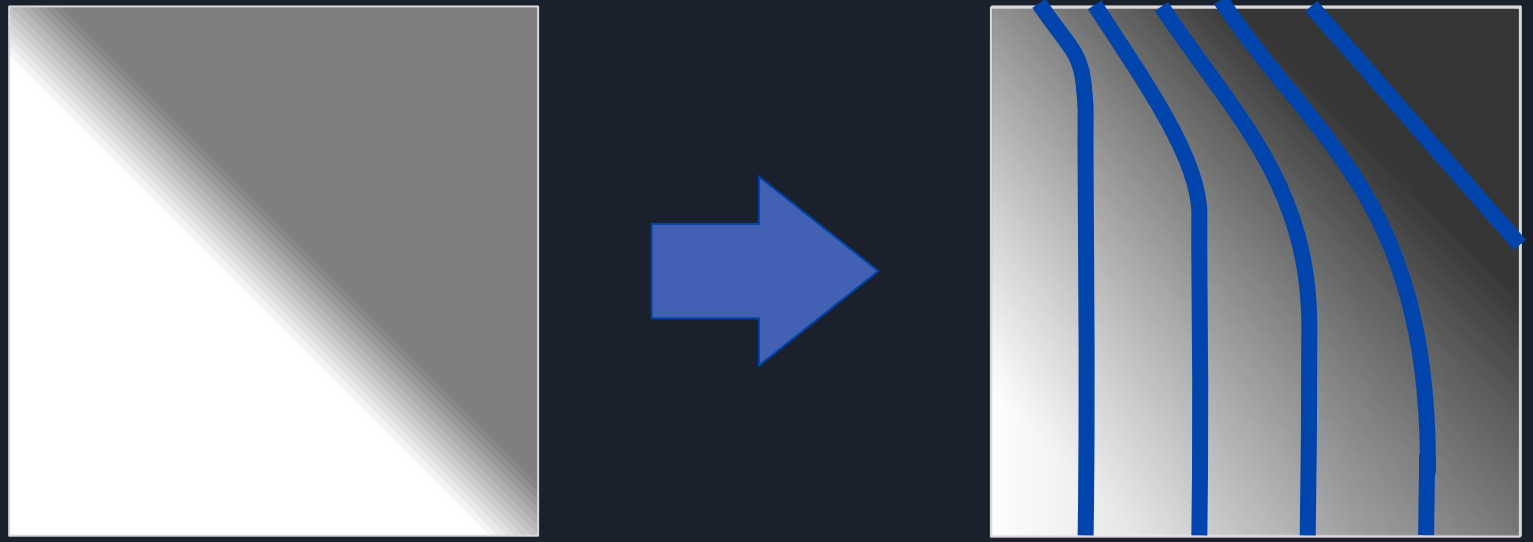
How to color the cells ?

Through quantization



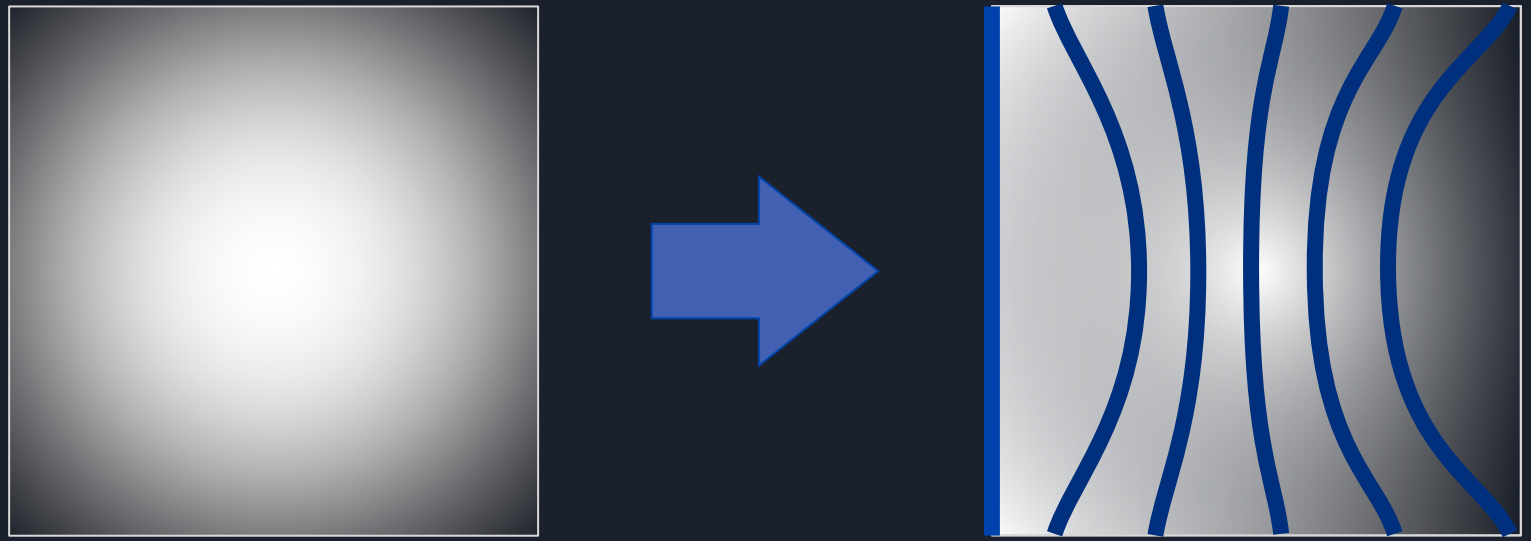
Control over orientation

Is just a mapping of $R^2 \Rightarrow R^2$

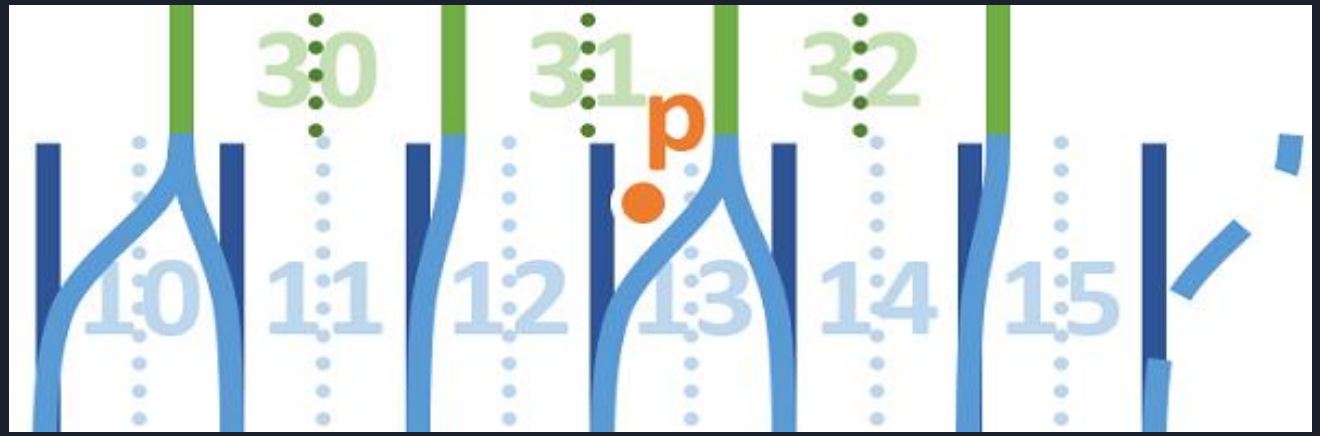


Control over density

Is just another mapping of $R^2 => R^2$



Quantization with mapping


30
31
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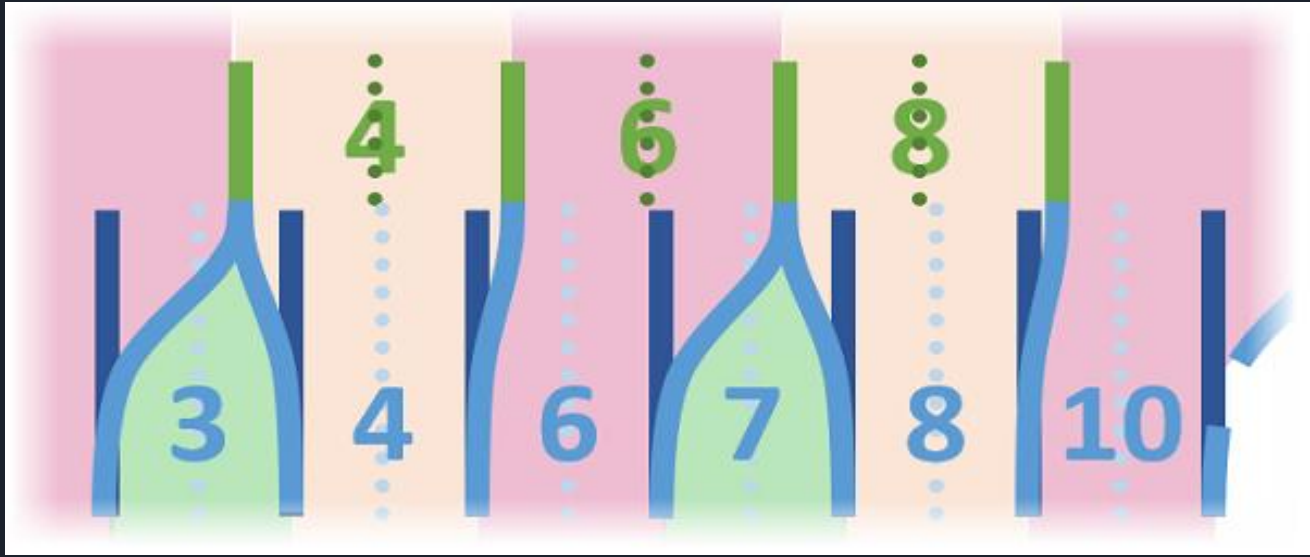
4
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