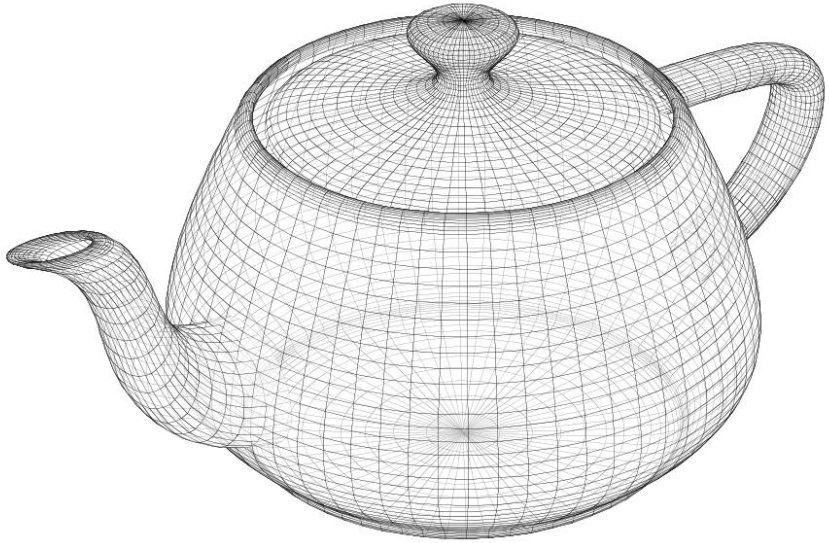
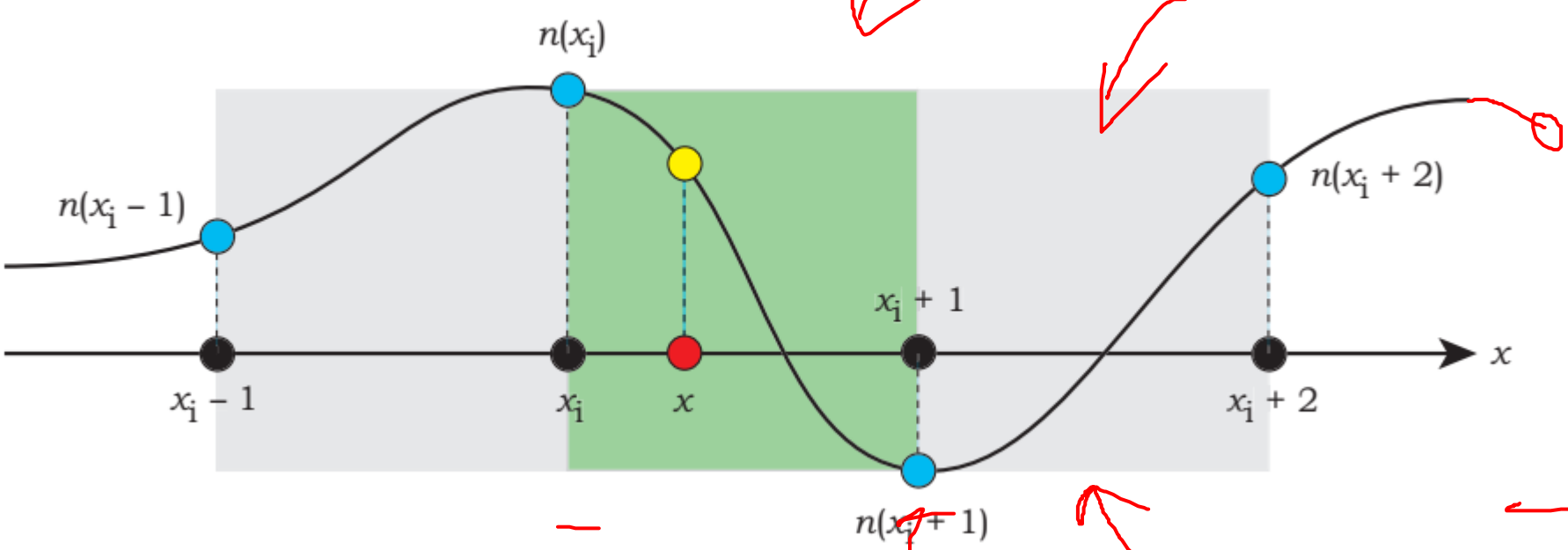


Noise-Based Textures: Cubic Interpolation

Production Computer Graphics

Eric Shaffer

Cubic Interpolation



Catmull-Rom Splines

- Cubic splines will interpolate 4 values (the control points)
  - Determines the coefficients in $ax^3 + bx^2 + cx + d$
- To find n(x), need 4 function values (2 on each side)
- Resulting composite function is C1 continuous
- It is not C2 continuous.
- Curve may lie outside bounding box of control points

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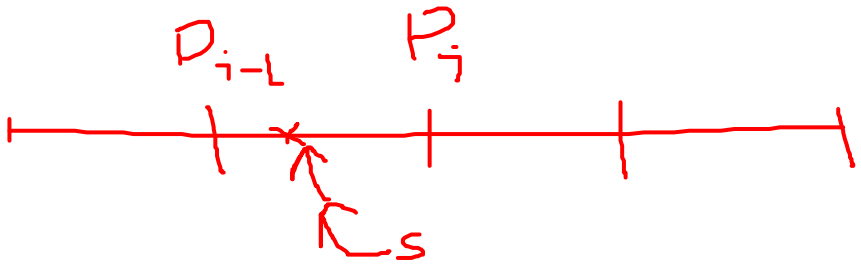
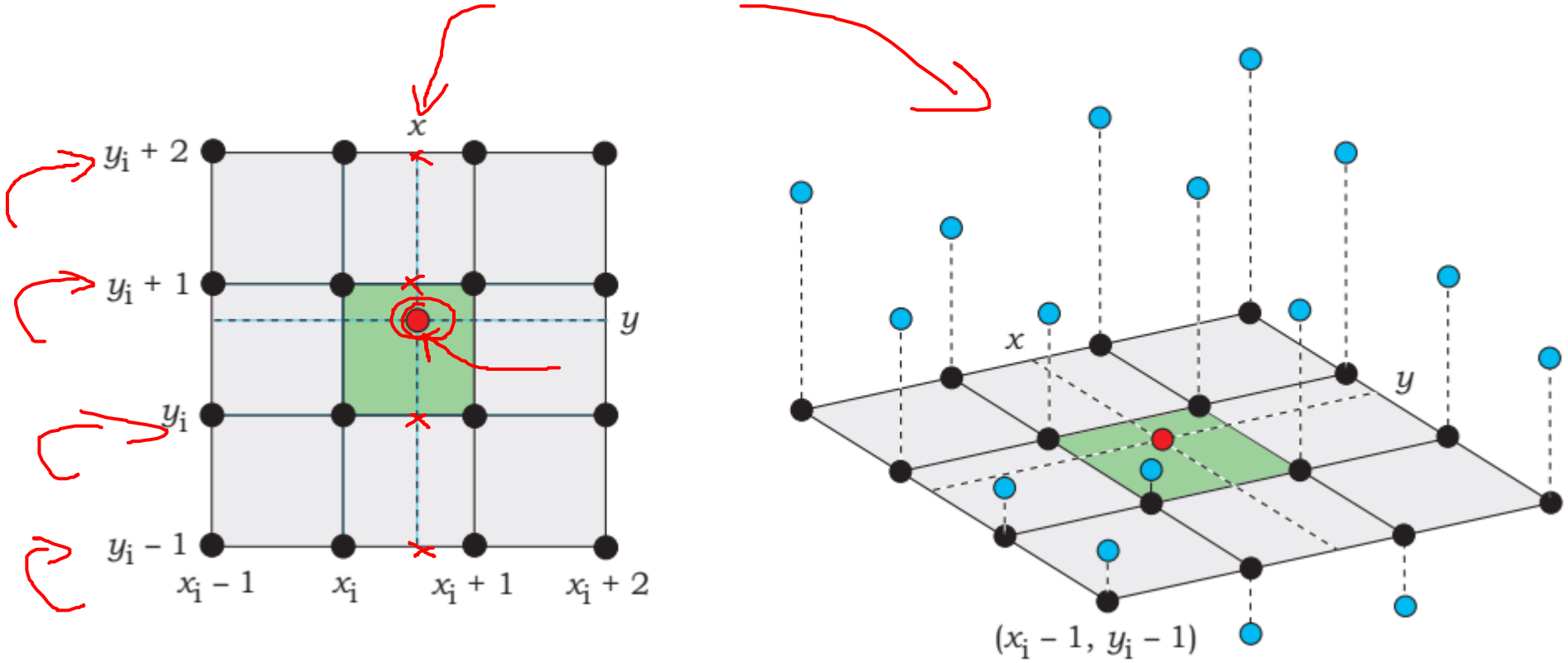
Cubic Catmull-Rom Spline

- Here u is where we are evaluating the function value
- We'll take τ= 0.5
- For a 1D domain, the p_i values will just be the prn function values of the lattice

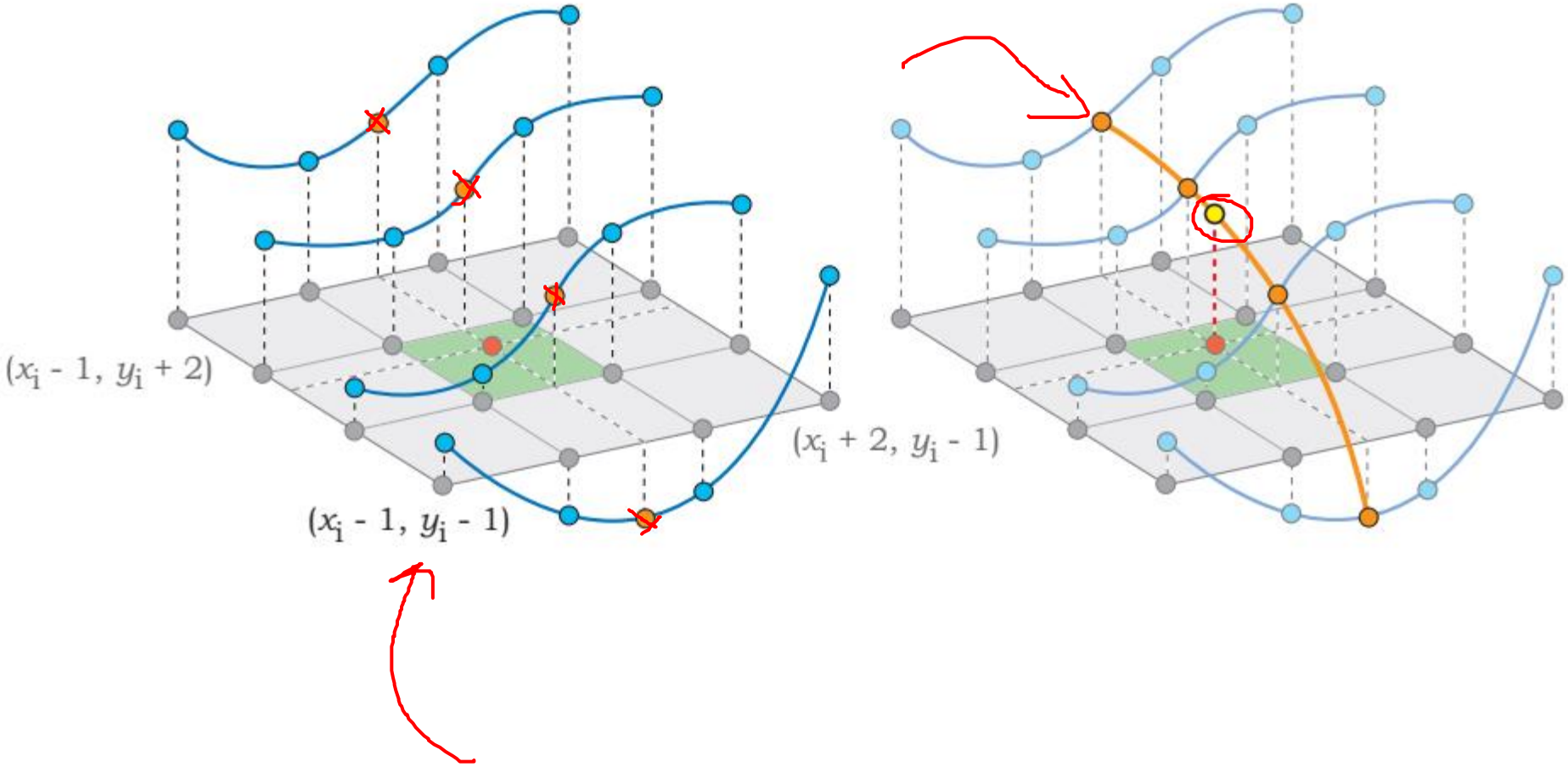
$$\mathbf{p}(s) = \begin{bmatrix} 1 & u & u^2 & u^3 \end{bmatrix} \begin{bmatrix} 0 & 1 & 0 & 0 \\ -\tau & 0 & \tau & 0 \\ 2\tau & \tau - 3 & 3 - 2\tau & -\tau \\ -\tau & 2 - \tau & \tau - 2 & \tau \end{bmatrix} \begin{bmatrix} \mathbf{p}_{i-2} \\ \mathbf{p}_{i-1} \\ \mathbf{p}_i \\ \mathbf{p}_{i+1} \end{bmatrix}$$



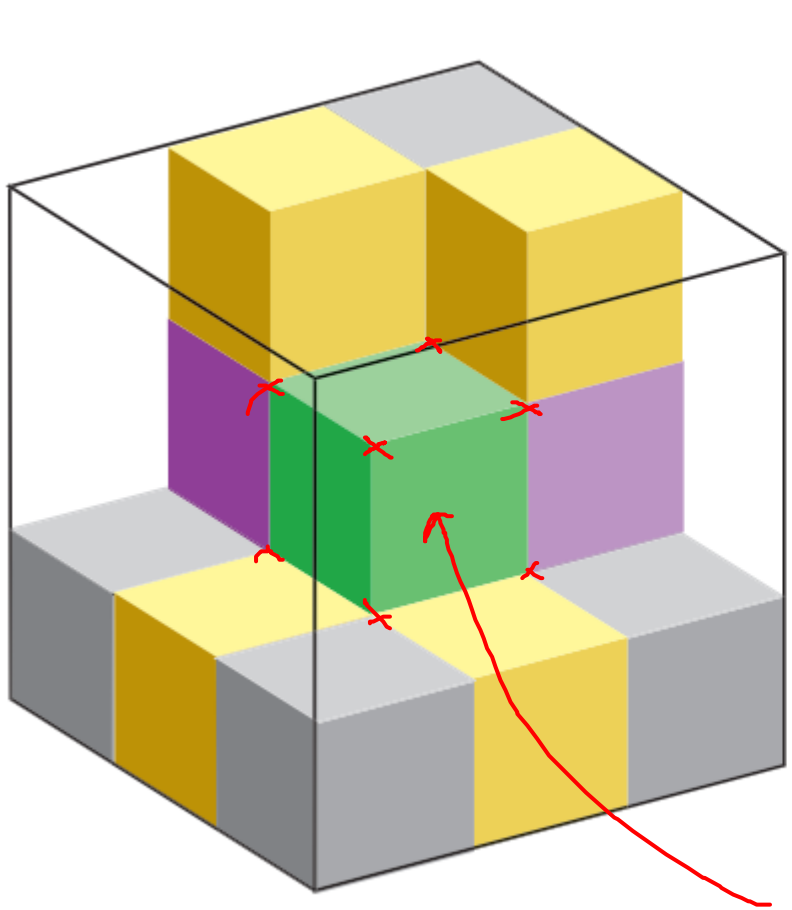
Bicubic Interpolation

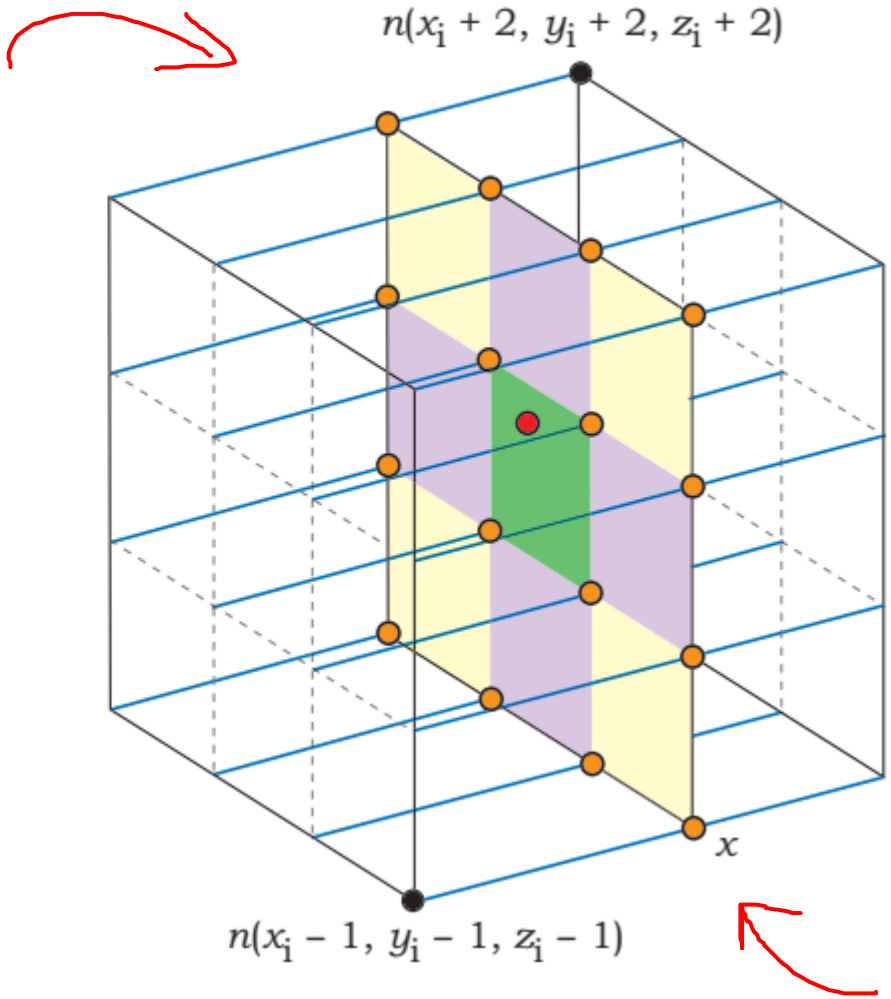


Bicubic Interpolation

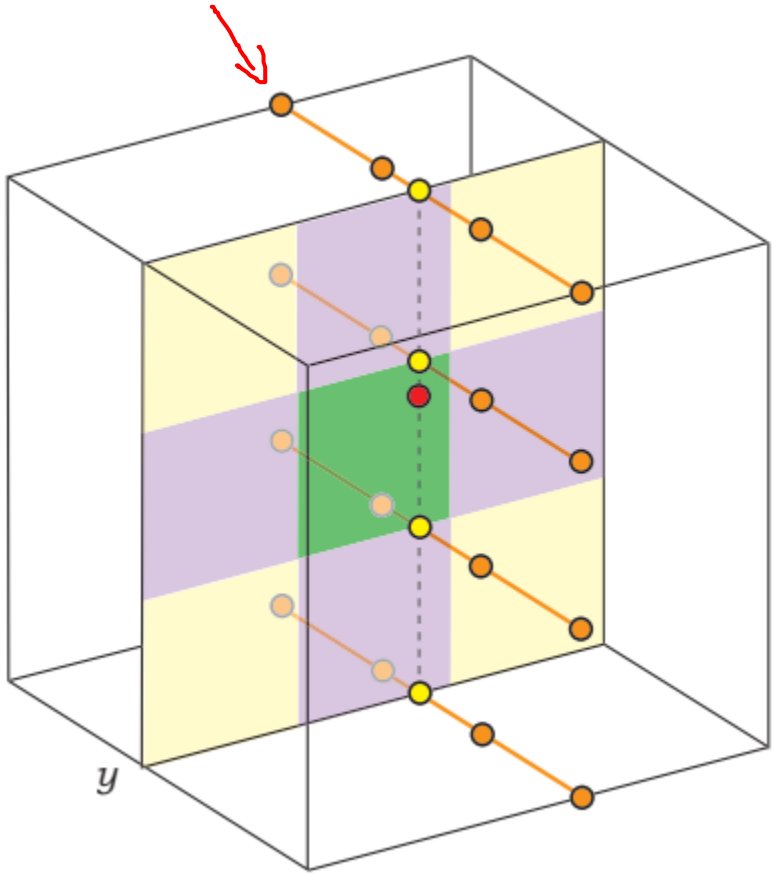


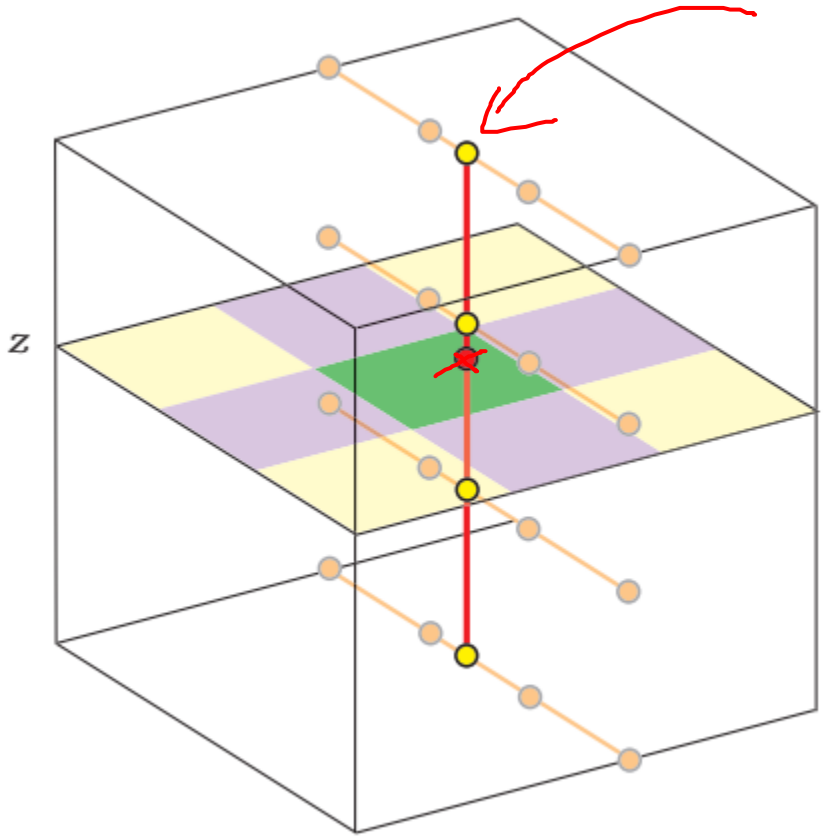
Tricubic Interpolation





Tricubic Interpolation





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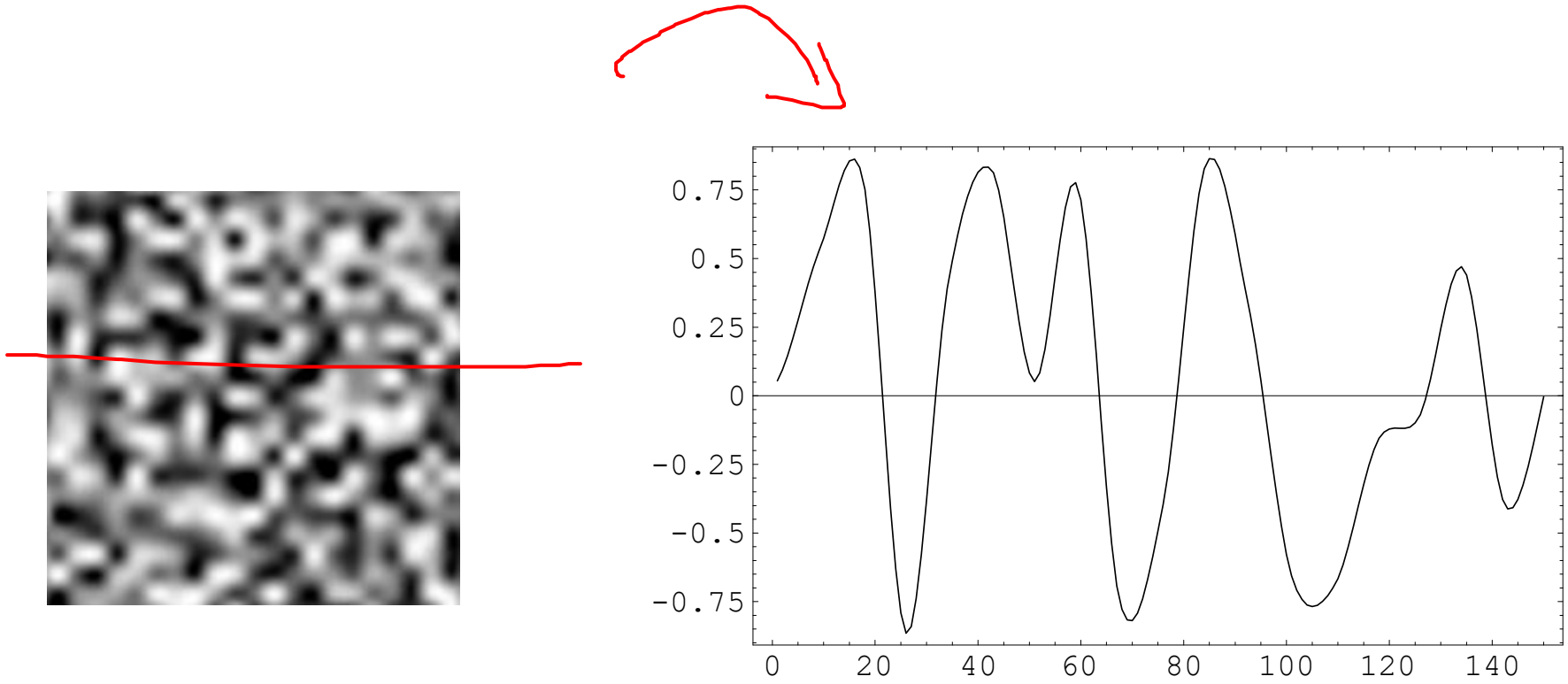
Examples



Overshooting

- Imagine a random noise function should produce values in [-1,1]
- Catmull-Rom spline can report interpolated values outside that range
- So…you need to clamp the values to the range [-1,1]