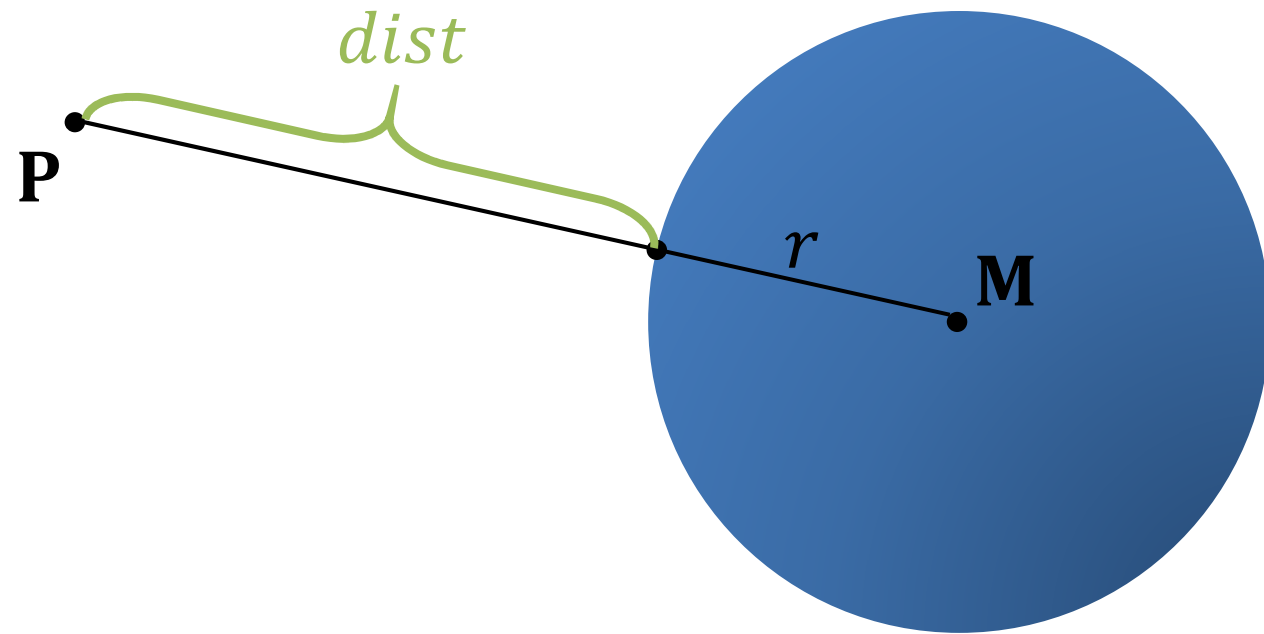


Raymarching Distance Fields

Distance Functions

- Distance function sphere

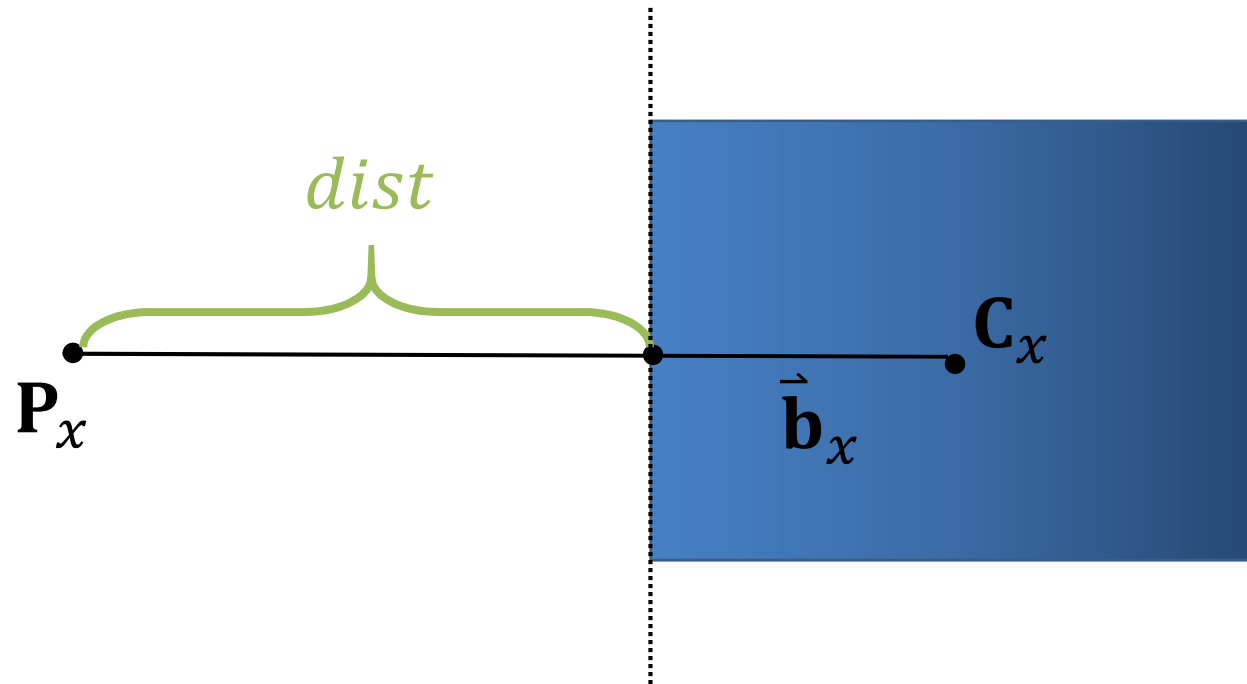
$$\textit{dist}(\mathbf{P}) = \|\mathbf{P} - \mathbf{M}\| - r$$



Distance Functions

- Distance function box – x -direction

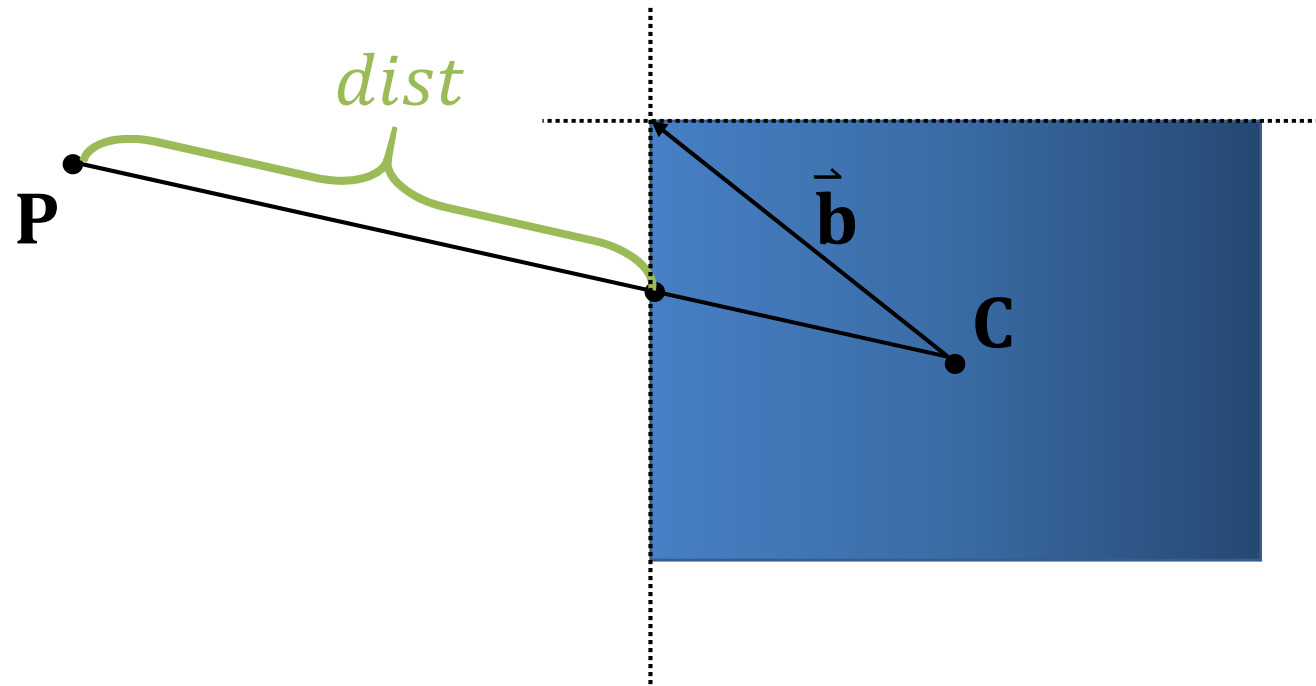
$$\textit{dist}(\mathbf{P}_x) = \max(|\mathbf{P}_x - \mathbf{C}_x| - \vec{\mathbf{b}}_x, 0)$$



Distance Functions

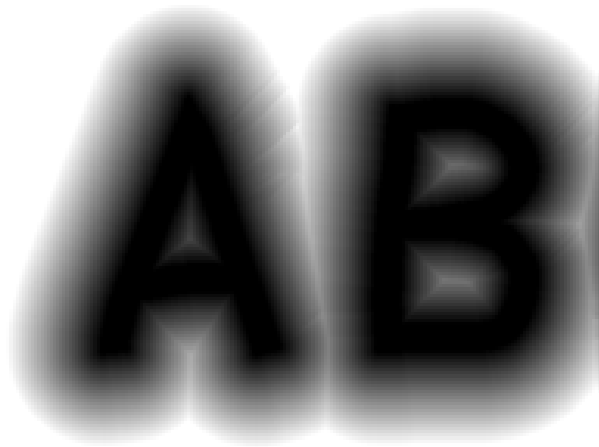
- Distance function box

$$\text{dist}(\mathbf{P}) = \|\max(|\mathbf{P} - \mathbf{C}| - \vec{\mathbf{b}}, \vec{\mathbf{0}})\|$$

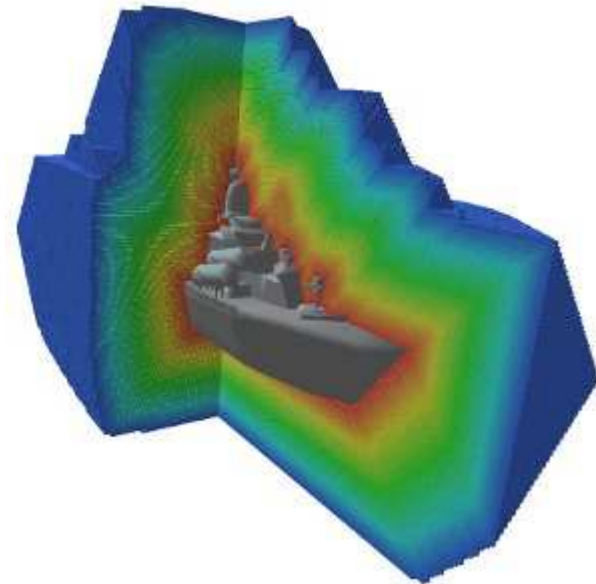


Distance Fields

$$\mathbb{R}^2 \rightarrow \text{dist}(\mathbb{R}^2)$$

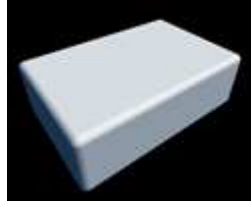


$$\mathbb{R}^3 \rightarrow \text{dist}(\mathbb{R}^3)$$



Operations on Distance Fields

- Given $dist(\mathbb{R}^3) =$

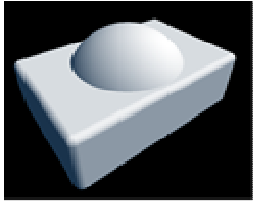


$$= dist(repeat(\mathbb{R}^3))$$

- Repeat is $\text{mod}(\mathbf{P}, \vec{\mathbf{b}}) - \frac{1}{2}\vec{\mathbf{b}}$

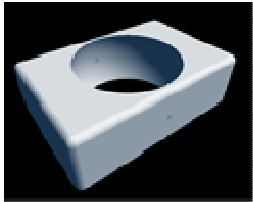
Operations on Distance Fields

- Given $dist_1(\mathbb{R}^3)$ and $dist_2(\mathbb{R}^3)$


$$= \text{union} \left(\text{box}, \text{sphere} \right)$$

The image shows a 3D visualization of the union operation. On the left is a white rectangular box with a white sphere on top of it. To the right of an equals sign is the word 'union' in italics, followed by a large left parenthesis. Inside the parenthesis are two images: a white rectangular box and a white sphere, separated by a comma. The parenthesis closes on the right.

- The union is $\min(dist_1(\mathbb{R}^3), dist_2(\mathbb{R}^3))$


$$= \text{subtraction} \left(\text{box}, \text{sphere} \right)$$

The image shows a 3D visualization of the subtraction operation. On the left is a white rectangular box with a white sphere cut out of its top surface. To the right of an equals sign is the word 'subtraction' in italics, followed by a large left parenthesis. Inside the parenthesis are two images: a white rectangular box and a white sphere, separated by a comma. The parenthesis closes on the right.

- The subtraction is $\max(-dist_1(\mathbb{R}^3), dist_2(\mathbb{R}^3))$

Raymarching Distance Fields

- $dist(\mathbf{P}_i)$

