U.PORTO
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Interactive Graphics Systems

Triangle UV texture mapping coordinates calculation

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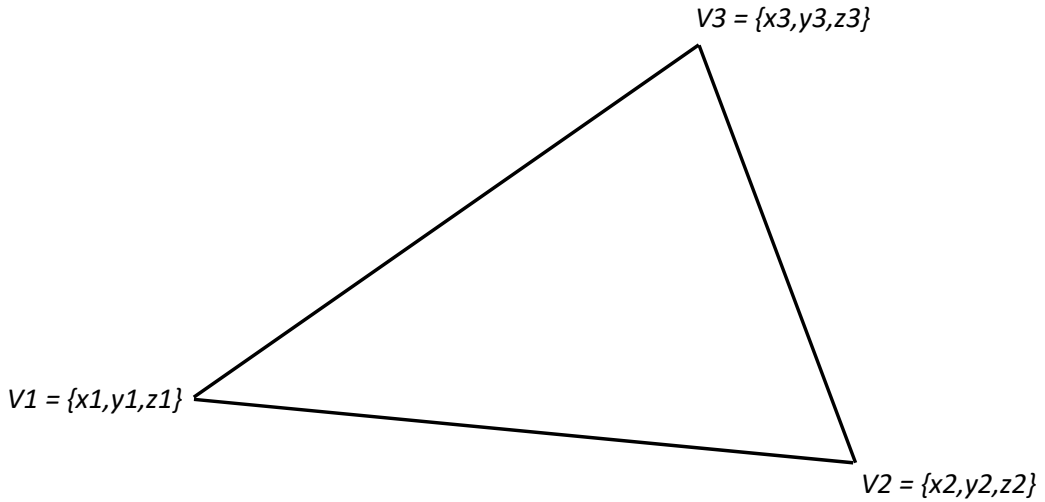
Pictures: two details of HCI from movie T*he Dark Knight (credits BLIND, Ltd.)*

Vertex definition

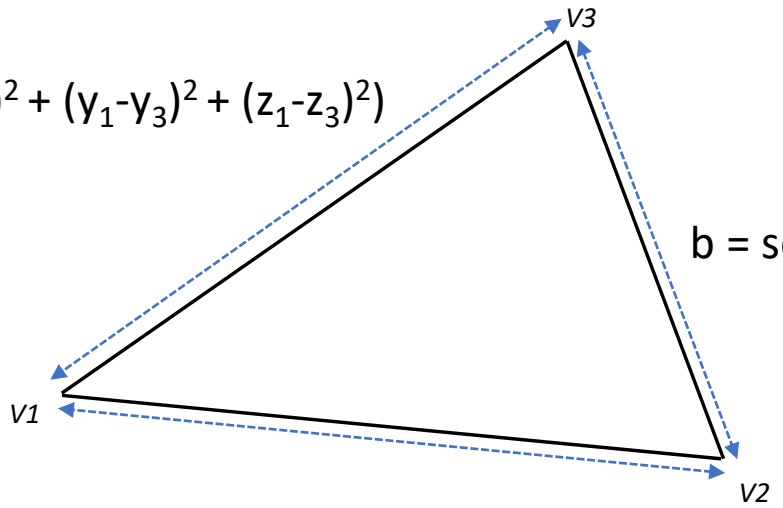


Distance calculation between vertices

Distances:

$a = \overline{V1\ V2}$
$b = \overline{V2\ V3}$
$c = \overline{V3\ V1}$

$c = \text{sqrt}((x_1-x_3)^2 + (y_1-y_3)^2 + (z_1-z_3)^2)$

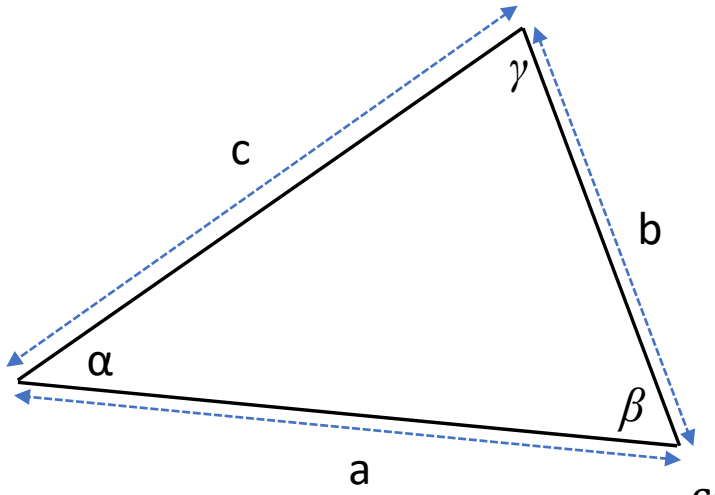


$b = \text{sqrt}((x_3-x_2)^2 + (y_3-y_2)^2 + (z_3-z_2)^2)$

$a = \text{sqrt}((x_2-x_1)^2 + (y_2-y_1)^2 + (z_2-z_1)^2)$

Internal angle calculation for α, β, γ

$$\cos(\gamma) = \frac{-a^2 + b^2 + c^2}{2bc}$$



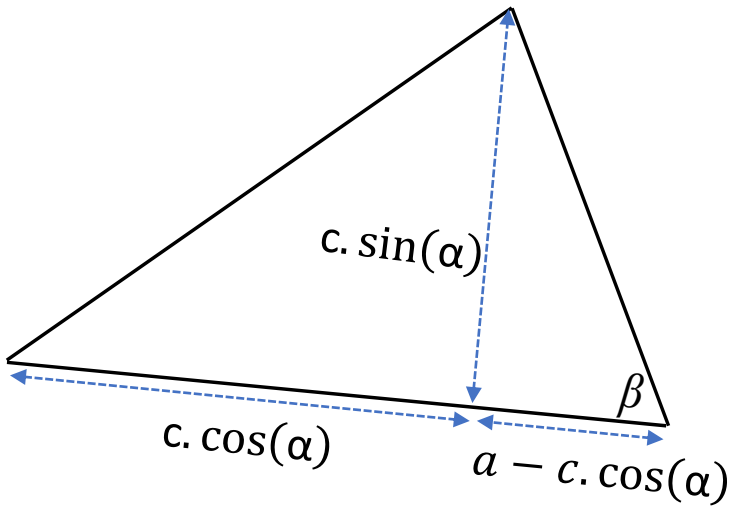
$$\cos(\alpha) = \frac{a^2 - b^2 + c^2}{2ac}$$

$$\cos(\beta) = \frac{a^2 + b^2 - c^2}{2ab}$$

NOTE: α, β, γ are lowercase greek letters alfa, beta and gamma, respectivelly. Commonly represente angles.

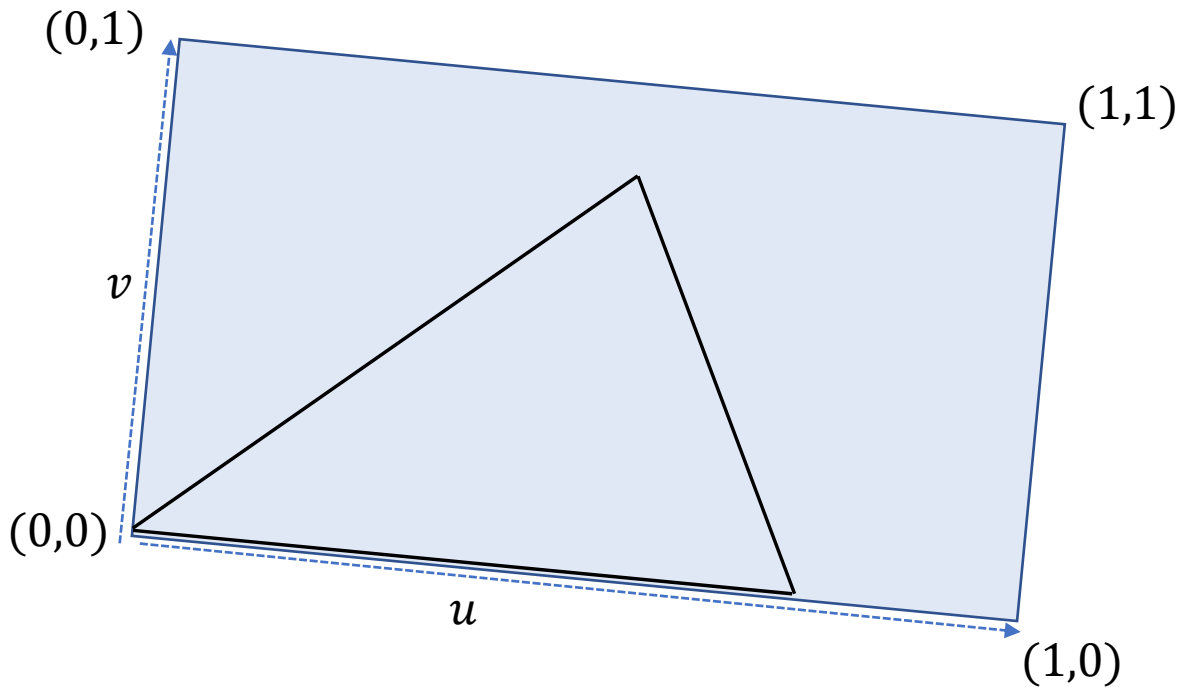
Internal distances calculation with respect to β

a and ***b*** are distances between vertices (previous slide).

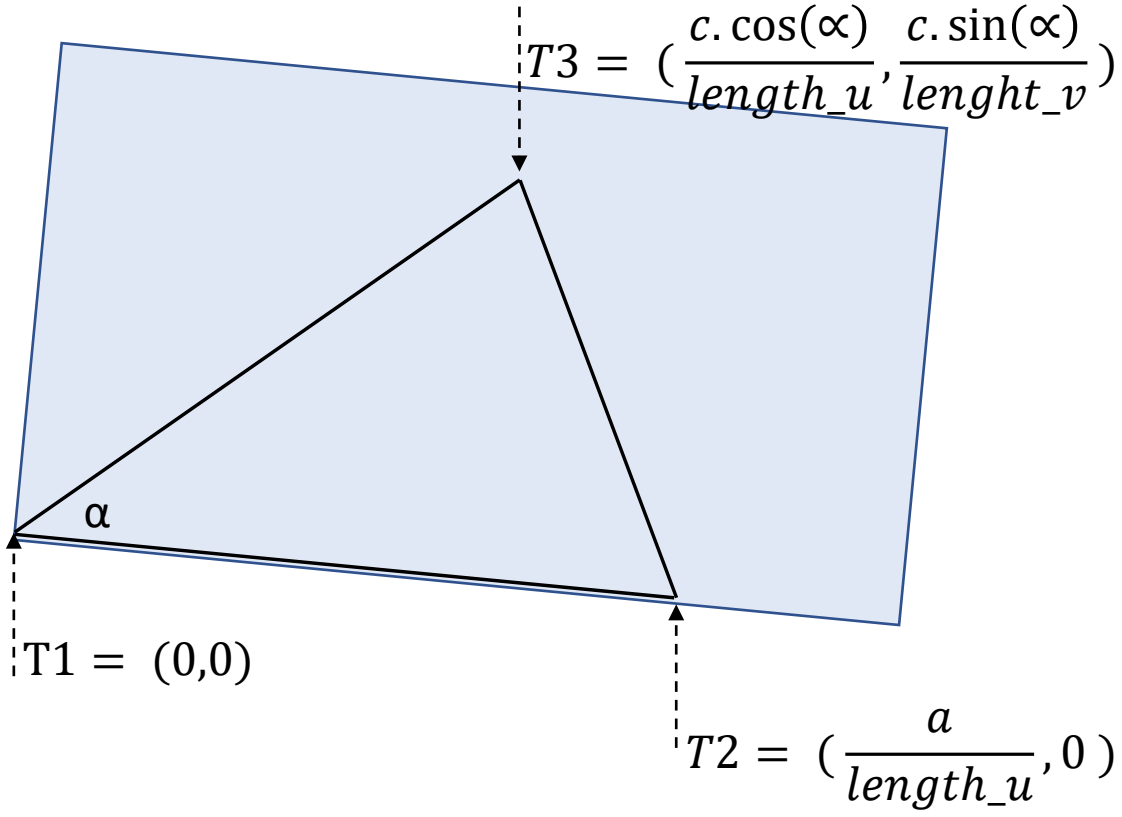


UV map layout over triangle

Assuming ***u*** and ***v*** normalized



UV texture mapping coordinates calculation
T1, T2 and T3 for vertices V1, V2 and V3
(supported by angle α)



$$\cos(\alpha) = \frac{a^2 - b^2 + c^2}{2ac}$$

$$\sin(\alpha) = \sqrt{1 - cos^2(\propto)}$$

NOTE: The letters "U" and "V" denote the axes of the 2D texture because "X", "Y", and "Z" are already used to denote the axes of the 3D object in model space. So, **length_u** refers to the size in U (X axis in 2D texture space) and **length_v** denotes the size in V (Y axis in 2D texture space). Some literature also uses “S” and “T” letters instead of “U” and “V”, respectively.