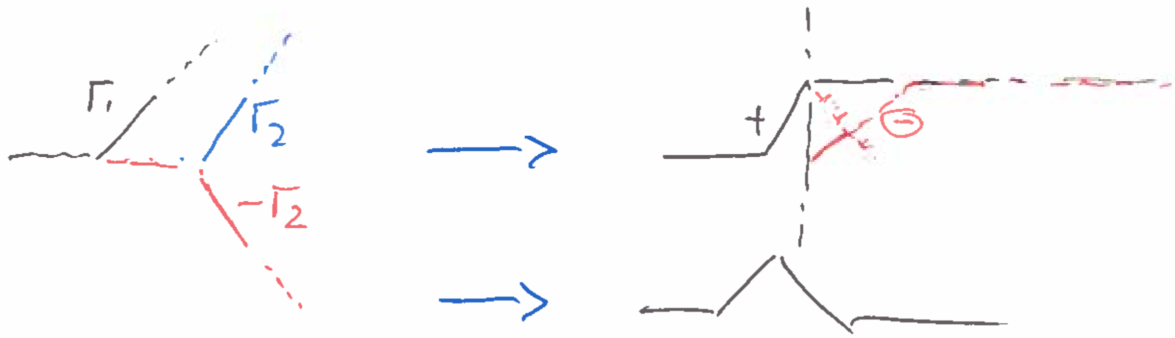
uniform spline

coefficients $\dots 0\,0\,0\,1\,2\,3\,4 \dots$



Differential Geometry (1 variable)

$$\mathbb{x} : u \in \mathbb{R} \longrightarrow (x(u), y(u), z(u)) \in \mathbb{R}^3 \qquad \text{space curve}$$

$$\underset{\text{nabla}}{\nabla} \mathbb{x} = (\underset{\frac{dx}{du}}{x'}, y', z') \qquad \text{gradient}$$

$$\underset{\text{arc length}}{s(t)} := \int_0^t \underbrace{\|(\nabla \mathbb{x})(u)\|_2 \, du}_{ds \sim \text{arc element}} \sim \sum_{i=0}^{n} \|\mathbb{x}(u_{i+1}) - \mathbb{x}(u_i)\|_2$$

$$\cancel{s_t} = \frac{ds}{dt} = \|(\nabla \mathbb{x})(u)\|$$

$$\mathbb{x}_s := \frac{d}{ds} \mathbb{x}(u(s)) = (\nabla \mathbb{x})(u(s)) \cdot \frac{du}{ds} = \frac{\nabla \mathbb{x}(u(s))}{\|\nabla \mathbb{x}(u)\|}$$

$$\perp \begin{pmatrix} 2 \\ -1 \end{pmatrix} = \begin{pmatrix} +1 \\ 2 \end{pmatrix}$$

$$\mathbb{x}_s \cdot \mathbb{x}_s = 1 \implies 2\, \mathbb{x}_{ss} \cdot \mathbb{x}_s = 0$$

$$\sqrt{\mathbb{x}_s \cdot \mathbb{x}_s}^{\,2} = 1^2 \qquad \| \mathbb{x}_s \|_2^2$$

→ FRÉNET FRAME = coordinate system

$t := \mathbb{x}_s$ tangent

$b := \mathbb{x}_s \times \mathbb{x}_{ss}$ bi-normal

$m := b \times x_s$ main normal