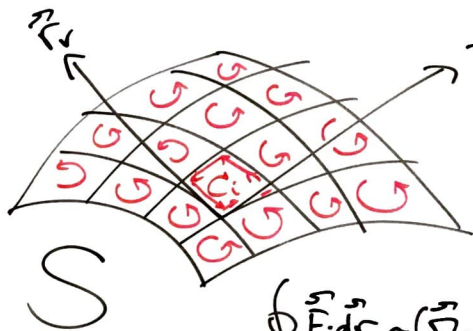
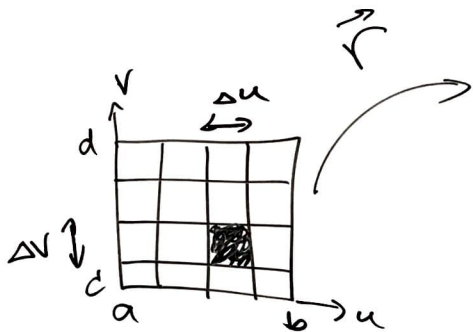
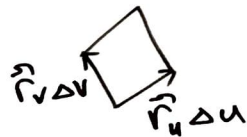


$$S = \{ \vec{r}(u,v) \mid a \leq u \leq b, c \leq v \leq d \}$$



$$\Delta S = \hat{n} \Delta S$$

$$\vec{r}_u = (\vec{r}_u \times \vec{r}_v) \Delta u \Delta v$$



$$\oint_C \vec{F} \cdot d\vec{r} \approx (\vec{\nabla} \times \vec{F}) \cdot \Delta S$$

$$\approx (\vec{\nabla} \times \vec{F}) \cdot (\vec{r}_u \times \vec{r}_v) \Delta u \Delta v$$

$$\oint_C \vec{F} \cdot d\vec{r} \approx \sum_{i=1}^n \oint_{C_i} \vec{F} \cdot d\vec{r} \approx \sum_{i=1}^n (\vec{\nabla} \times \vec{F}) \cdot (\vec{r}_u \times \vec{r}_v) \Delta u \Delta v$$

as  $n \rightarrow \infty$

$$\boxed{\oint_C \vec{F} \cdot d\vec{r} = \iint_S (\vec{\nabla} \times \vec{F}) \cdot d\vec{S}}$$

