Global	Local
$S \subseteq \mathbb{R}^3$	$\varphi : \mathbb{R}^2 \to S$
$T_p S \subseteq \mathbb{R}^3$	$T_{\varphi(v,u)} S \simeq \text{span}\{\underbrace{\varphi_u, \varphi_v}_{\text{basis}}\}$
$N : S \to \mathbb{R}^3$	$N \circ \varphi : \mathbb{R}^2 \to \mathbb{R}^3$ $(N \circ \varphi)(u,v) := \dfrac{(\varphi_u \wedge \varphi_v)(u,v)}{\\|\varphi_u \wedge \varphi_v\\|}$
$dN_p : T_p S \to T_p S$	$A(u,v) : \mathbb{R}^2 \to \mathbb{R}^2$
$I_p : T_p S \times T_p S \to \mathbb{R}$ $I_p = \langle \cdot , \cdot \rangle$	$M_{(u,v)} = \begin{pmatrix} E(u,v) & F(u,v) \\ F(u,v) & G(u,v) \end{pmatrix}$ $\Rightarrow E(u,v) = \langle \varphi_u(u,v), \varphi_u(u,v) \rangle = \\|\varphi_u(u,v)\\|^2$ $F(u,v) = \langle \varphi_u(u,v), \varphi_v(u,v) \rangle$ $G(u,v) = \langle \varphi_v(u,v), \varphi_v(u,v) \rangle = \\|\varphi_v(u,v)\\|^2$
$II_p : T_p S \times T_p S \to \mathbb{R}$ $II_p = - \langle dN_p(\cdot), \cdot \rangle$	$\Sigma(u,v) = \begin{pmatrix} e(u,v) & f(u,v) \\ f(u,v) & g(u,v) \end{pmatrix}$ $\Rightarrow e(u,v) = \langle (N \circ \varphi)(u,v), \varphi_{uu}(u,v) \rangle$ $f(u,v) = \langle (N \circ \varphi)(u,v), \varphi_{uv}(u,v) \rangle$ $g(u,v) = \langle (N \circ \varphi)(u,v), \varphi_{vv}(u,v) \rangle$
	$\Rightarrow A = \dfrac{-1}{EG - F^2} \begin{pmatrix} G & -F \\ -F & E \end{pmatrix} \begin{pmatrix} e & f \\ f & g \end{pmatrix}$
$K(p) = \det(dN_p)$	$(K \circ \varphi)(u,v) = \det A(u,v)$ $= \dfrac{eg - f^2}{EG - F^2}$
$H(p) = -\frac{1}{2} \operatorname{tr}(dN_p)$	$(H \circ \varphi)(u,v) = -\frac{1}{2} \operatorname{tr}(A)$ $= \frac{1}{2} \dfrac{eG + gE - 2fF}{EG - F^2}$