

but some differentiation, etc
gets

$$\begin{pmatrix} f_{uu} & f_{uv} \\ f_{uv} & f_{vv} \end{pmatrix} \begin{pmatrix} f_u & f_v \\ f_v & f_u \end{pmatrix} = \begin{pmatrix} \frac{1}{2}(g_{11u} + g_{22u}) & g_{12u} \\ \frac{1}{2}(g_{11v} + g_{22v}) & g_{12v} \end{pmatrix}$$

Now in this C-sys, param, we have

$$K \Big|_{0,0} = \det \begin{pmatrix} f_{uu} & f_{uv} \\ f_{uv} & f_{vv} \end{pmatrix} \Big|_{0,0} \quad \left(\text{which you should check!} \right)$$

$$= \det \begin{pmatrix} \frac{1}{2}(g_{11u} + g_{22u}) & g_{12u} \\ \frac{1}{2}(g_{11v} + g_{22v}) & g_{12v} \end{pmatrix}$$

$$\frac{f_u^2 - f_v^2}{}$$

$$g_{11} - g_{22}$$

So we are done!