$$A\times(B\times C)=(A\cdot C)B-(A\cdot B)C\neq(A\times B)\times C,$$

Lagrange' identity: $\quad (v\times w)\cdot(a\times b)=(v\cdot a)(w\cdot b)-(v\cdot b)(w\cdot a)$

$$\frac{ds}{dt}=|\alpha'(t)|=\nu(t),\quad T(t):=\frac{\alpha'(t)}{\nu(t)},\quad \kappa(s):=\left|\frac{dT}{ds}\right|,\quad N(s):=\frac{\frac{dT}{ds}}{\kappa(s)},\quad B:=T\times N,\quad \tau(s):=\frac{dN}{ds}\cdot B$$

$$\begin{array}{lclll}
\frac{dT}{dt}=\frac{dT}{ds}\frac{ds}{dt} & = & & \kappa\frac{ds}{dt}N & \\
\frac{dN}{dt}=\frac{dN}{ds}\frac{ds}{dt} & = & -\kappa\frac{ds}{dt}T & & +\tau\frac{ds}{dt}B \\
\frac{dB}{dt}=\frac{dB}{ds}\frac{ds}{dt} & = & & -\tau\frac{ds}{dt}N. &
\end{array}$$

The normal curvature in the direction of a unit vector u: $\quad k(u):=S_p(u)\cdot u$

Euler's formula: $\quad k(u)=k_1\cos^2\theta+k_2\sin^2\theta$

$$S(\varphi_u)\cdot\varphi_u=\varphi_{uu}\cdot U,\quad S(\varphi_u)\cdot\varphi_v=S(\varphi_v)\cdot\varphi_u=\varphi_{uv}\cdot U,\quad S(\varphi_v)\cdot\varphi_v=\varphi_{vv}\cdot U$$

$$\begin{pmatrix} l & m\\ m & n\end{pmatrix}=\begin{pmatrix} E & F\\ F & G\end{pmatrix}\begin{pmatrix} a & c\\ b & d\end{pmatrix}$$

$$K=\frac{ln-m^2}{EG-F^2},\quad H=\frac{Gl+En-2Fm}{2(EG-F^2)},\quad k_1=H+\sqrt{H^2-K},\quad k_2=H-\sqrt{H^2-K}$$

$$\kappa_\alpha^2=k_n(T_\alpha)^2+(k_g)_\alpha^2$$

The geodesic equations in the case $F=0$: $\quad u''+\frac{E_u}{2E}u'^2+\frac{E_v}{E}u'v'-\frac{G_u}{2E}v'^2=0,\quad v''+\frac{G_v}{2G}v'^2+\frac{G_u}{G}u'v'-\frac{E_v}{2G}u'^2=0.$

$$\begin{array}{lcllll}
\nabla_v E_1 & = & & \omega_{12}(v)E_2 & +\omega_{13}(v)E_3\\
\nabla_v E_2 & = & \omega_{21}(v)E_1 & & +\omega_{23}(v)E_3\\
\nabla_v E_3 & = & \omega_{31}(v)E_1 & +\omega_{32}(v)E_2 &
\end{array}$$

In $\mathbb{R}^3$:

$$\begin{pmatrix} E_1\\ E_2\\ E_3\end{pmatrix}=A\begin{pmatrix} U_1\\ U_2\\ U_3\end{pmatrix},\quad \Theta=A\begin{pmatrix} dx\\ dy\\ dz\end{pmatrix},\quad \Omega=(dA)(A^t),\quad \text{Structural equations:}\quad d\Theta=\Omega\wedge\Theta,\quad d\Omega=\Omega\wedge\Omega$$

On a surface:

First structural equations: $\quad d\theta_1=\omega_{12}\wedge\theta_2,\quad d\theta_2=\omega_{21}\wedge\theta_1$

Symmetry equation: $\quad \omega_{31}\wedge\theta_1+\omega_{32}\wedge\theta_2=0$

Gauss equation: $\quad d\omega_{12}=\omega_{13}\wedge\omega_{32}$

Codazzi equations: $\quad d\omega_{13}=\omega_{12}\wedge\omega_{23},\quad d\omega_{23}=\omega_{21}\wedge\omega_{13}$

$$d\omega_{12}=\omega_{13}\wedge\omega_{32}=-K\theta_1\wedge\theta_2,\quad \omega_{13}\wedge\theta_2+\theta_1\wedge\omega_{23}=2H\theta_1\wedge\theta_2$$

Matrix of S on the basis $\{E_1,E_2\}$: $\quad \begin{pmatrix}\omega_{13}(E_1) & \omega_{13}(E_2)\\ \omega_{23}(E_1) & \omega_{23}(E_2)\end{pmatrix}$