

Differential Geometry QRG

Functions	DESCRIPTION	REMARKS
KHT	Curvature & Torsion 3D-parametric Curve X(t) Y(t) Z(t) h ↑ t -> $\chi(t)$ X<>Y $\tau(t)$	/
KGS	Gaussian Curvature of a surface $z = f(x,y)$ • R00 = f name h ↑ y ↑ x -> K(Gauss)	/
dF	1st- 2nd- 3rd-derivative of a function of 1 variable • R00 = f name h ↑ x -> f(x) RDN f''(x) RDN f'''(x)	/
dF2	Derivatives of a function of 2 variables • R00 = f name h ↑ y ↑ x -> f'_x RDN f'_y RDN f''_xx RDN f''_yy	/
dF3	Derivatives of a function of 3 variables • R00 = f name h ↑ z ↑ y ↑ x -> f'_x RDN f'_y RDN f'_z RDN Δf	/
MDV	Mixed Derivative of a function of 2 var. • R00 = f name h ↑ y ↑ x -> f''_xy	/
BHRM	Biharmonic Operator of a function of 3 var. • R00 = f name h ↑ z ↑ y ↑ x -> $\Delta^2 f$	/
CDGL	Curl-Diverg-Grad-Lapl E = [X(x,y,z) Y(x,y,z) Z(x,y,z)] h ↑ z ↑ y ↑ x -> Curl ₁ RDN Curl ₂ RDN Curl ₃ RDN Div E L = 4.019 (contr. numb. all results)	CF01 CF 02 = Rect Coord. SF 01 CF 02 = Cyl Coord. CF 01 SF 02 = Sph. Coord.
FD	First Deriv. funct n var. (n < 10) • R00 = f name • R01 = x ₁ , ..., • Rnn = x _n h ↑ i -> $\partial f / \partial x_i$	SF03 -> X'=0 if X = alpha h > 0 = order10 h < 0 = order 4
SD	2nd Deriv. funct n var. (n < 10) • R00 = f name • R01 = x ₁ , ..., • Rnn = x _n h ↑ j ↑ i -> $\partial^2 f / \partial x_i \partial x_j$	X'=0 if X = alpha h > 0 = order10 h < 0 = order 4
LAPL	Laplacian funct n var. (n < 10) • R00 = f name • R01 = x ₁ , ..., • Rnn = x _n h ↑ n -> Δf	X'=0 if X = alpha h > 0 = order10 h < 0 = order 4
LS	Solves linear systems, p = small Nb for tiny elements, rr = nb of rows bbb.eeerr ↑ p -> det M	/
/	N-DIMENSIONAL RIEMANNIAN MANIFOLDS	/
INIGC	Initialization: • R01 = x ₁ , ..., • Rnn = x _n h ↑ n -> 41.eee = control nb of g_{ij} , g^{ij} and Γ_{ij}^k	SF 04 -> g_{ij} , g^{ij} only
CIJK	Recalls Γ_{ij}^k IF "INIGC" has been executed i ↑ j ↑ k -> Γ_{ij}^k	/
RIJKL	Covariant Curvature Tensor $i \uparrow j \uparrow k \uparrow l \rightarrow R_{ijkl} = (1/2) (\partial_{jk} g_{il} + \partial_{il} g_{jk} - \partial_{jl} g_{ik} - \partial_{ik} g_{jl}) + g_{mp} (\Gamma_{jk}^m \Gamma_{il}^p - \Gamma_{jl}^m \Gamma_{ik}^p)$	/
RIJK^L	Curvature Tensor (1-3) i ↑ j ↑ k ↑ l -> $R_{ijkl}^1 = g^{lm} R_{mijk}$	/
RIJ	Ricci Tensor i ↑ j -> $R_{ij} = g^{km} R_{ikjm}$	/
RR	Scalar Riemannian Curvature / -> $R = g^{ij} R_{ij}$	/

EIJ	Einstein Tensor $i \uparrow j \rightarrow E_{ij} = R_{ij} - (1/2) R g_{ij}$	XEQ "RR" first $\rightarrow R38 = R$
WIJKL	Weyl Tensor $i \uparrow j \uparrow k \uparrow l \rightarrow W_{ijkl}$ $W_{ijkl} = R_{ijkl} + [1/(n-2)] (R_{il}g_{jk} - R_{ik}g_{jl} + R_{jk}g_{il} - R_{jl}g_{ik}) + [R/(n-1)/(n-2)] (g_{ik}g_{jl} - g_{il}g_{jk})$	XEQ "RR" first $\rightarrow R38 = R$
DKTIJ	Covariant Differentiation Tensor $bbb.eee \uparrow i \uparrow j \uparrow k \rightarrow D_k T_{ij}$ or $D_k T^{ij}$ or $D_k T^i_j$ or Vector $bbb.eee \uparrow i \uparrow k \rightarrow D_k V_i$ or $D_k V^i$	CF 01 CF 02 covariant SF 01 1 contrav SF 02 2 contrav
RCURL	Curl of a Cov Vector Field $bbb.eee \rightarrow \text{Curl}_{ij} V = \partial_i V_j - \partial_j V_i$	/
RDIV	Dvg of a Contr. Vect Fied $bbb.eee \rightarrow \text{Div } V = \partial_i V^i + \Gamma^i_{ik} V^k$	/
RLAPGR	Laplacian & Gradient of a Scalar Field • R00 = f name / $\rightarrow \text{Lapl}(f) = g^{jk} (\partial_{jk} f - \Gamma^i_{jk} \partial_i f)$ X \leftrightarrow Y $bbb.eee(\text{Gradient})$	/
V \leftrightarrow V $^\wedge$	Exchanging Covariant & Contravariant Coord. of a Vector $bbb.eee(V_i) \rightarrow bbb.eee(V^i)$	SF 01 = inverse operation
/	GENERAL DIFFERENTIAL MANIFOLDS	
2RIJK $^\wedge$ L	2 Curvature Tensors: with conx Γ^k_{ij} & with transp conx Γ^k_{ji} $i \uparrow j \uparrow k \uparrow l \rightarrow R^l_{ijk} = \partial_j \Gamma^l_{ik} - \partial_k \Gamma^l_{ij} + \Gamma^l_{mj} \Gamma^m_{ik} - \Gamma^l_{mk} \Gamma^m_{ij}$ OR $R^l_{ijk} = \partial_j \Gamma^l_{ki} - \partial_k \Gamma^l_{ji} + \Gamma^l_{jm} \Gamma^m_{ki} - \Gamma^l_{km} \Gamma^m_{ji}$	CF 02 = first Tensor SF 02 = second Tensor
RQIJ	Ricci Tensors $i \uparrow j \rightarrow R_{ij} = R^m_{imj}$ Segm. Curv. Tensors $i \uparrow j \rightarrow Q_{ij} = R^m_{mij} = \partial_i \Gamma^m_{mj} - \partial_j \Gamma^m_{mi}$	CF 00 = Ricci Tensor SF 00 = Segmental Curv. CF 02 & SF 02 as above
RQ	Scalar Curvatures / $\rightarrow R = g^{ij} R_{ij}$ / $\rightarrow Q = g^{ij} Q_{ij}$	CF 00 = R SF 00 = Q CF 02 & SF 02 as above
SIJK	Torsion Tensor $i \uparrow j \uparrow k \rightarrow S^k_{ij} = \Gamma^k_{ij} - \Gamma^k_{ji}$	/
SJ	Torsion Vector $j \rightarrow S_j = S^k_{jk}$	/