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> restart :
> with(DifferentialGeometry) :
> with(Tools) : with(LinearAlgebra) :
> DGsetup([z, y, u[1], u[2], u[3]], [a, h, k], M, verbose);
    The following coordinates have been protected:
          [z, y, u1, u2, u3, a, h, k]
    The following vector fields have been defined and protected:
          [Dz, Dy, Du1, Du2, Du3, Da, Dh, Dk]
    The following differential 1-forms have been defined and protected:
          [dz, dy, du1, du2, du3, da, dh, dk]
          frame name: M

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(1)

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> Ma := Matrix([[a4, 0, 0, 0, 0], [0, a3, 0, 0, 0], [0, 0, a2, 0, 0], [h, 0, 0, a, 0], [k, 0, 0, 0, a]]);

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$$Ma := \begin{bmatrix} a^4 & 0 & 0 & 0 & 0 \\ 0 & a^3 & 0 & 0 & 0 \\ 0 & 0 & a^2 & 0 & 0 \\ h & 0 & 0 & a & 0 \\ k & 0 & 0 & 0 & a \end{bmatrix}$$

(2)

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> MaInv := MatrixInverse(Ma) :

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> A := map(evalDG, (ExteriorDerivative(Ma).MaInv));

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$$A := \begin{bmatrix} \frac{4 da}{a} & 0 dz & 0 dz & 0 dz & 0 dz \\ 0 dz & \frac{3 da}{a} & 0 dz & 0 dz & 0 dz \\ 0 dz & 0 dz & \frac{2 da}{a} & 0 dz & 0 dz \\ -\frac{h da}{a^5} + \frac{dh}{a^4} & 0 dz & 0 dz & \frac{da}{a} & 0 dz \\ -\frac{k da}{a^5} + \frac{dk}{a^4} & 0 dz & 0 dz & 0 dz & \frac{da}{a} \end{bmatrix}$$

(3)

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M > t[1] := \frac{da}{a} :

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M > t[2] := -\frac{h da}{a^5} + \frac{dh}{a^4} : t[3] := -\frac{k da}{a^5} + \frac{dk}{a^4} :

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M > V := Vector\left(\left[-\frac{1}{12} Iy^3 dz + \frac{1}{12} Iz^3 dy + \left(\frac{1}{4} z^2 + \frac{1}{2} zy + \frac{1}{4} y^2\right) du_1 + \left(-\frac{1}{4} z - \frac{1}{4} y\right) du_2 + \frac{1}{12} du_3, \frac{1}{4} Iy^2 dz - \frac{1}{4} Iz^2 dy + \left(-\frac{1}{2} z - \frac{1}{2} y\right) du_1 + \frac{1}{4} du_2, -\frac{1}{2} Iy dz + \frac{1}{2} Iz dy + \frac{1}{2} du_1, dz, dy\right]\right) :

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M > $W := Ma.V :$

M > $FD := FrameData([t[1], t[2], t[3], W[1], W[2], W[3], W[4], W[5]], N) :$

M > $DGsetup(FD, [E], [\alpha[1], \alpha[2], \alpha[3], \tau, \sigma, \rho, \zeta, \zeta^\#], verbose);$

The following coordinates have been protected:

$$[z, y, u_1, u_2, u_3, a, h, k]$$

The following vector fields have been defined and protected:

$$[E1, E2, E3, E4, E5, E6, E7, E8]$$

The following differential 1-forms have been defined and protected:

$$[\alpha_1, \alpha_2, \alpha_3, \tau, \sigma, \rho, \zeta, \zeta^\#]$$

frame name: N

(4)

M > $ExteriorDerivative(\tau);$

$$4 \alpha_1 \wedge \tau + \frac{(h+k) \tau \wedge \sigma}{a^4} + \sigma \wedge \zeta + \sigma \wedge \zeta^\#$$

(5)

N > $ExteriorDerivative(\sigma);$

$$3 \alpha_1 \wedge \sigma + \frac{(h+k) \tau \wedge \rho}{a^4} + \rho \wedge \zeta + \rho \wedge \zeta^\#$$

(6)

N > $ExteriorDerivative(\rho);$

$$2 \alpha_1 \wedge \rho + \frac{I k \tau \wedge \zeta}{a^4} - \frac{I h \tau \wedge \zeta^\#}{a^4} + I \zeta \wedge \zeta^\#$$

(7)

N > $ExteriorDerivative(\zeta);$

$$\alpha_1 \wedge \zeta + \alpha_2 \wedge \tau + \frac{h(h+k) \tau \wedge \sigma}{a^8} + \frac{h \sigma \wedge \zeta}{a^4} + \frac{h \sigma \wedge \zeta^\#}{a^4}$$

(8)

N > $ExteriorDerivative(\zeta^\#);$

$$\alpha_1 \wedge \zeta^\# + \alpha_3 \wedge \tau + \frac{k(h+k) \tau \wedge \sigma}{a^8} + \frac{k \sigma \wedge \zeta}{a^4} + \frac{k \sigma \wedge \zeta^\#}{a^4}$$

(9)

N >