MOTION AND CONFORMAL MOTION IN A FOUR DIMENSIONAL FINSLER SPACE

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Abstract:

The aim of the present paper is to discuss the motion and conformal motion in a four dimensional Finsler space. In this paper, we find the conditions on the main scalars and the connection vectors for an infinitesimal transformation to be a motion and a conformal motion.

Keywords: Motion, Conformal Motion, Four dimensional Finsler Space

1. Introduction

In a three dimensional Finsler space, there are three main scalars H, I, J and two connection vectors h and v. B. N. Prasad and A. K. Jaiswal discussed motion in two and three dimensional Finsler spaces [1]. In a four dimensional Finsler space, there are eight main scalars A, B, C, D, E, F, G, H and three *h*-connection vectors h, j, k and three *v*-connection vectors u, v, w [2].

2. Scalar Components in Orthonormal Miron Frame

Let F^4 be a four dimensional Finsler space. The Miron frame for this space is constructed by unit vectors (l^i, m^i, n^i, p^i) where $l^i = \dot{x}^i / L$ is normalized supporting element, $m^i = C^i / \tilde{c}$ is normalized torsion vector, n^i is constructed by

$g_{ij}l^i n^j = g_{ij}m^i n^j = 0$, $g_{ij}n^i n^j = 1$, and p^i satisfies $g_{ij}l^i p^j = g_{ij}m^i p^j = g_{ij}n^i p^j = 0$, $g_{ij}p^i p^j = 1$ and $\tilde{c}$ is length of C^i.

In Miron frame, an arbitrary tensor $T = (T^i_j)$ is expressed in terms of scalar components as

(2.1) $$T^i_j = T_{\alpha\beta}\, e^i_{\alpha)}\, e_{\beta)j} ,$$

while the tensor T^i_{jk} is expressed as

(2.2) $$T^i_{jk} = T_{\alpha\beta\gamma}\, e^i_{\alpha)}\, e_{\beta)j}\, e_{\gamma)k} ,$$

where $e^i_{1)} = l^i$, $e^i_{2)} = m^i$, $e^i_{3)} = n^i$, $e^i_{4)} = p^i$ and the summation convention is applied to the indices α, β, γ.

Since the scalar components of the fundamental metric tensor g_{ij} are $\delta_{\alpha\beta}$, we have

(2.3) $$g_{ij} = \delta_{\alpha\beta} = e_{\alpha)i}e_{\beta)j} = l_i l_j + m_i m_j + n_i n_j + p_i p_j .$$

Let $C_{\lambda\mu\nu}$ be the scalar components of LC_{ijk} with respect to Miron frame. Then

(2.4) $$LC_{ijk} = C_{\lambda\mu\nu}\, e_{\lambda)i}\, e_{\mu)j}\, e_{\nu)k} .$$

M. Matsumoto [3] showed that

1) $C_{\lambda\mu\nu}$ are completely symmetric.

2) $C_{1\mu\nu} = 0$

3) $C_{2\mu\mu} = L\tilde{c}$, $C_{3\mu\mu} = C_{4\mu\mu} = \ldots\ldots\ldots\ldots = C_{n\mu\mu} = 0$.

Therefore in a four dimensional Finsler space, we have

$$C_{222}+C_{233}+C_{244}=L\tilde{c},$$

(2.5a) $$C_{322}+C_{333}+C_{344}=0,$$

$$C_{422}+C_{433}+C_{444}=0.$$

Putting

(2.5b) $$C_{222}=A,\quad C_{233}=B,\quad C_{244}=C,\quad C_{322}=D,$$
$$C_{333}=E,\quad C_{422}=F,\quad C_{433}=G,\quad C_{234}=H.$$

We get $C_{344}=-(D+E),\qquad C_{444}=-(F+G).$

Thus $A,\ B,C,D,E,F,G,H$ are main scalars of the four dimensional Finsler space.

Equation (2.4) may be written as

$$LC_{ijk}=A(m_im_jm_k)+B(m_in_jn_k+n_im_jn_k+n_in_jm_k)$$
$$+C(m_ip_jp_k+p_im_jp_k+p_ip_jm_k)$$
$$+D(m_im_jn_k+m_in_jm_k+n_im_jm_k)+E(n_in_jn_k)$$
(2.6) $$+F(m_im_jp_k+m_ip_jm_k+p_im_jm_k)+G(n_in_jp_k$$
$$+n_ip_jn_k+p_in_jn_k)+H(m_in_jp_k+m_ip_jn_k$$
$$+n_im_jp_k+n_ip_jm_k+p_im_jn_k+p_in_jm_k)$$
$$-(D+E)(n_ip_jp_k+p_in_jp_k+p_ip_jn_k)-(F+G)(p_ip_jp_k).$$

Let $H_{\alpha)\beta\gamma}$ and $\frac{1}{L}V_{\alpha)\beta\gamma}$ be scalar components of the h- and v-covariant derivatives $e^i_{\alpha)|j}$ and $e^i_{\alpha)}|_j$ of $e^i_{\alpha)}$ respectively. Then, we have

(2.7a) $$e^i_{\alpha)|j}=H_{\alpha)\beta\gamma}\,e^i_{\beta)}e_{\gamma)j}$$

(2.7b) $$Le^i_{\alpha)}|_j=V_{\alpha)\beta\gamma}\,e^i_{\beta)}e_{\gamma)j}$$

We now define vector fields

(2.8) $$h_i=H_{2)3\gamma}e_{\gamma)i},\qquad j_i=H_{4)2\gamma}e_{\gamma)i},\qquad k_i=H_{3)4\gamma}e_{\gamma)i},$$

(2.9) $u_i = V_{2)3\gamma} e_{\gamma)i}, \quad v_i = V_{4)2\gamma} e_{\gamma)i}, \quad w_i = V_{3)4\gamma} e_{\gamma)i}.$

The vector fields h_i, j_i, k_i are called h-connection vectors and u_i, v_i, w_i are called v-connection vectors. The scalars $H_{2)3\gamma}, H_{4)2\gamma}, H_{3)4\gamma}$ are scalar components of h-connection vectors h_i, j_i, k_i and $V_{2)3\gamma}, V_{4)2\gamma}, V_{3)4\gamma}$ are scalar components of v-connection vectors u_i, v_i, w_i .

From (2.7) we get

(2.10)
$$(a) \quad e^i_{1)|j} = l^i_{|j} = 0,$$
$$(b) \quad e^i_{2)|j} = m^i_{|j} = n^i h_j - p^i j_j,$$
$$(c) \quad e^i_{3)|j} = n^i_{|j} = p^i k_j - m^i h_j,$$
$$(d) \quad e^i_{4)|j} = p^i_{|j} = m^i j_j - n^i k_j.$$

and

(2.11)
$$(a) \quad Le^i_{1)}|_j = Ll^i|_j = m^i m_j + n^i n_j + p^i p_j,$$
$$(b) \quad Le^i_{2)}|_j = Lm^i|_j = -l^i m_j + n^i u_j - p^i v_j,$$
$$(c) \quad Le^i_{3)}|_j = Ln^i|_j = -l^i n_j - m^i u_j + p^i w_j,$$
$$(d) \quad Le^i_{4)}|_j = Lp^i|_j = -l^i p_j + m^i v_j - n^i w_j.$$

3. Lie Derivatives of g_{ij} and LC^i_{jk} in Terms of Scalar Components

Let us consider an infinitesimal transformation

(3.1) $$\bar{x}^i = x^i + X^i dt$$

generated by a tangent vector field $X^i(x)$ of M^n.

The corresponding

variation in y^i is $\bar{y}^i = y^i + (\partial_j X^i) y^j dt$

given by

(3.2)

This transformation gives a process of differentiation called Lie Differentiation.

The Lie derivative $£_X$ of mixed tensor T^i_j with respect to above infinitesimal transformation is given by [4]

(3.3) $$£_X T^i_j = T^i_{j|r} X^r + T^i_j|_r w^r - T^r_j A^i_r + T^i_r A^r_j,$$

where A^i_j and w^i are (1,1) and (1,0) type tensor fields defined by

(3.4) $$A^i_j = X^i_{|j} + C^i_{jr} w^r.$$

(3.5) $$w^i = X^i_{|0}.$$

Let X_α, $\alpha = 1,2,3,4$ be scalar components of the tangent vector field $X^i(x)$ of the transformation (3.1) then

(3.6) $$X^i = X_\alpha e^i_{\alpha)} = X_1 e^i_{1)} + X_2 e^i_{2)} + X_3 e^i_{3)} + X_4 e^i_{4)}$$
$$= X_1 l^i + X_2 m^i + X_3 n^i + X_4 p^i.$$

If $X_{\alpha,\beta}$ be scalar components of $X^i_{|j}$, then

(3.7) $$X^i_{|j} = X_{\alpha,\beta} e^i_{\alpha)} e_{\beta)j},$$

and

(3.8) $$X^i_{|0} = L X_{\alpha,1} e^i_{\alpha)}$$

In view of (3.5), (3.8) may be written as

(3.9) $$w^i = L X_{\alpha,1} e^i_{\alpha)}.$$

From (3.4), (3.7) and (3.9), we have

(3.10) $$A^i_j = (X_{\alpha,\beta} + C_{\alpha\beta\lambda} X_{\lambda,1}) e^i_{\alpha)} e_{\beta)j}.$$

If $A_{\alpha\beta}$ are the scalar components of A^i_j , then

(3.11) $$A_{\alpha\beta} = X_{\alpha,\beta} + C_{\alpha\beta\lambda} X_{\lambda,1}$$

Now

$$A_{11} = X_{1,1} + C_{11\lambda} X_{\lambda,1} = X_{1,1}$$

$$A_{12} = X_{1,2} + C_{12\lambda} X_{\lambda,1} = X_{1,2}$$

$$A_{13} = X_{1,3} + C_{13\lambda} X_{\lambda,1} = X_{1,3}$$

$$A_{14} = X_{1,4} + C_{14\lambda} X_{\lambda,1} = X_{1,4}$$

$$A_{21} = X_{2,1} + C_{21\lambda} X_{\lambda,1} = X_{2,1}$$

for $C_{1\lambda\mu} = 0$.

Again, in view of (2.5b) and $C_{1\lambda\mu} = 0$, we have

$$A_{22} = X_{2,2} + C_{22\lambda} X_{\lambda,1} = X_{2,2} + AX_{2,1} + DX_{3,1} + FX_{4,1}$$

$$A_{23} = X_{2,3} + C_{23\lambda} X_{\lambda,1} = X_{2,3} + DX_{2,1} + BX_{3,1} + HX_{4,1}$$

$$A_{24} = X_{2,4} + C_{24\lambda} X_{\lambda,1} = X_{2,4} + FX_{2,1} + HX_{3,1} + CX_{4,1}$$

$$A_{31} = X_{3,1} + C_{31\lambda} X_{\lambda,1} = X_{3,1}$$

$$A_{32} = X_{3,2} + C_{32\lambda} X_{\lambda,1} = X_{3,2} + DX_{2,1} + BX_{3,1} + HX_{4,1}$$

$$A_{33} = X_{3,3} + C_{33\lambda} X_{\lambda,1} = X_{3,3} + BX_{2,1} + EX_{3,1} + GX_{4,1}$$

$$A_{34} = X_{3,4} + C_{34\lambda} X_{\lambda,1} = X_{3,4} + HX_{2,1} + GX_{3,1} - (D+E)X_{4,1}$$

$$A_{41} = X_{4,1} + C_{41\lambda} X_{\lambda,1} = X_{4,1}$$

$$A_{42} = X_{4,2} + C_{42\lambda} X_{\lambda,1} = X_{4,2} + FX_{2,1} + HX_{3,1} + CX_{4,1}$$

$$A_{43} = X_{4,3} + C_{43\lambda} X_{\lambda,1} = X_{4,3} + HX_{2,1} + GX_{3,1} - (D+E)X_{4,1}$$

$$A_{44} = X_{4,4} + C_{44\lambda} X_{\lambda,1} = X_{4,4} + CX_{2,1} - (D+E)X_{3,1} - (F+G)X_{4,1}$$

In view of (2.10), (2.11) and (3.9), the Lie derivatives of unit vectors are given by

(3.12)
$$£_X l^i = -X_{1,1} l^i,$$
$$£_X l_i = X_{1,1} l_i + (X_{1,2} + X_{2,1}) m_i + (X_{1,3} + X_{3,1}) n_i + (X_{1,4} + X_{4,1}) p_i,$$

$$\pounds_x m^i = -(X_{1,2} + X_{2,1})l^i - (X_{2,2} + AX_{2,1} + DX_{3,1} + FX_{4,1})m^i$$

$$+ (X_\alpha h_\alpha + X_{\alpha,1} u_\alpha - X_{3,2} - DX_{2,1} - BX_{3,1} - HX_{4,1})n^i$$

$$- (X_\alpha j_\alpha + X_{\alpha,1} v_\alpha + X_{4,2} + FX_{2,1} + HX_{3,1} + CX_{4,1})p^i,$$

$$\pounds_x m_i = (X_{2,2} + AX_{2,1} + DX_{3,1} + FX_{4,1})m_i + (X_\alpha h_\alpha + X_{\alpha,1} u_\alpha$$

$$+ X_{2,3} + DX_{2,1} + BX_{3,1} + HX_{4,1})n_i + (-X_\alpha j_\alpha$$

$$- X_{\alpha,1} v_\alpha + X_{2,4} + FX_{2,1} + HX_{3,1} + CX_{4,1})p_i,$$

$$\pounds_x n_i = (-X_\alpha h_\alpha - X_{\alpha,1} u_\alpha + X_{3,2} + DX_{2,1} + BX_{3,1} + HX_{4,1})m_i$$

$$+ (X_{3,3} + BX_{2,1} + EX_{3,1} + GX_{4,1})n_i + (X_\alpha k_\alpha + X_{\alpha,1} w_\alpha$$

$$+ X_{3,4} + HX_{2,1} + GX_{3,1} - (D+E)X_{4,1})p_i,$$

$$\pounds_x n^i = -(X_{1,3} + X_{3,1})l^i - (X_\alpha h_\alpha + X_{\alpha,1} u_\alpha + X_{2,3} + DX_{2,1} + BX_{3,1}$$

$$+ HX_{4,1})m^i - (X_{3,3} + BX_{2,1} + EX_{3,1} + GX_{4,1})n^i + (X_\alpha k_\alpha$$

$$+ X_{\alpha,1} w_\alpha - X_{4,3} - HX_{2,1} - GX_{3,1} + (D+E)X_{4,1})p^i,$$

$$\pounds_x p_i = (X_\alpha j_\alpha + X_{\alpha,1} v_\alpha + X_{4,2} + FX_{2,1} + HX_{3,1} + CX_{4,1})m_i + (X_{4,4}$$

$$+ CX_{2,1} - (D+E)X_{3,1} - (F+G)X_{4,1})p_i + (-X_\alpha k_\alpha - X_{\alpha,1} w_\alpha$$

$$+ X_{4,3} + HX_{2,1} + GX_{3,1} - (D+E)X_{4,1})n_i,$$

$$\pounds_x p^i = -(X_{1,4} + X_{4,1})l^i - (X_{4,4} + CX_{2,1} - (D+E)X_{3,1} - (F+G)X_{4,1})p^i$$

$$+ (X_\alpha j_\alpha + X_{\alpha,1} v_\alpha - X_{2,4} - FX_{2,1} - HX_{3,1} - CX_{4,1})m^i$$

$$-(X_\alpha k_\alpha + X_{\alpha,1} w_\alpha + X_{3,4} + HX_{2,1} + GX_{3,1} - (D+E)X_{4,1})n^i.$$

The Lie derivative of the metric tensor g_{ij} is given by

$$\pounds_x g_{ij} = L_X(l_i l_j + m_i m_j + n_i n_j + p_i p_j)$$

(3.13)
$$= l_i L_X(l_j) + l_j L_X(l_i) + m_i L_X(m_j) + m_j L_X(m_i) + n_i L_X(n_j)$$

$$+ n_j L_X(n_j) + p_i L_X(p_j) + p_j L_X(p_i).$$

$$
\begin{aligned}
&= l_i[X_{1,1}l_j + (X_{1,2}+X_{2,1})m_j + (X_{1,3}+X_{3,1})n_j + (X_{1,4}+X_{4,1})p_j] + l_j[X_{1,1}l_i \\
&+ (X_{1,2}+X_{2,1})m_i + (X_{1,3}+X_{3,1})n_i + (X_{1,4}+X_{4,1})p_i] + m_i[(X_{2,2}+AX_{2,1} \\
&+ DX_{3,1}+FX_{4,1})m_j + (X_\alpha h_\alpha + X_{\alpha,1}u_\alpha + X_{2,3}+DX_{2,1}+BX_{3,1}+HX_{4,1})n_j \\
&+ (-X_\alpha j_\alpha - X_{\alpha,1}v_\alpha + X_{2,4}+FX_{2,1}+HX_{3,1}+CX_{4,1})p_j] + m_j[(X_{2,2}+AX_{2,1} \\
&+ DX_{3,1}+FX_{4,1})m_i + (X_\alpha h_\alpha + X_{\alpha,1}u_\alpha + X_{2,3}+DX_{2,1}+BX_{3,1}+HX_{4,1})n_i \\
&+ (-X_\alpha j_\alpha - X_{\alpha,1}v_\alpha + X_{2,4}+FX_{2,1}+HX_{3,1}+CX_{4,1})p_i] + n_i[(-X_\alpha h_\alpha \\
&- X_{\alpha,1}u_\alpha + X_{3,2}+DX_{2,1}+BX_{3,1}+HX_{4,1})m_j + (X_{3,3}+BX_{2,1}+EX_{3,1} \\
&+ GX_{4,1})n_j + (X_\alpha k_\alpha + X_{\alpha,1}w_\alpha + X_{3,4}+HX_{2,1}+GX_{3,1}-(D+E)X_{4,1})p_j \\
&+ n_j[(-X_\alpha h_\alpha - X_{\alpha,1}u_\alpha + X_{3,2}+DX_{2,1}+BX_{3,1}+HX_{4,1})m_i + (X_{3,3}+BX_{2,1} \\
&+ EX_{3,1}+GX_{4,1})n_i + (X_\alpha k_\alpha + X_{\alpha,1}w_\alpha + X_{3,4}+HX_{2,1}+GX_{3,1}-(D+E)X_{4,1})p_i \\
&+ p_i[(X_\alpha j_\alpha + X_{\alpha,1}v_\alpha + X_{4,2}+FX_{2,1}+HX_{3,1}+CX_{4,1})m_j + (X_{4,4}+CX_{2,1} \\
&- (D+E)X_{3,1} - (F+G)X_{4,1})p_j + (-X_\alpha k_\alpha - X_{\alpha,1}w_\alpha + X_{4,3}+HX_{2,1}+GX_{3,1} \\
&- (D+E)X_{4,1})n_j] + p_j[(X_\alpha j_\alpha + X_{\alpha,1}v_\alpha + X_{4,2}+FX_{2,1}+HX_{3,1}+CX_{4,1})m_i \\
&+ (X_{4,4}+CX_{2,1}-(D+E)X_{3,1}-(F+G)X_{4,1})p_i + (-X_\alpha k_\alpha - X_{\alpha,1}w_\alpha \\
&+ X_{4,3}+HX_{2,1}+GX_{3,1}-(D+E)X_{4,1})n_i]
\end{aligned}
$$

$$
\begin{aligned}
= \quad & 2X_{1,1}l_il_j + 2(X_{2,2}+AX_{2,1}+DX_{3,1}+FX_{4,1})m_im_j + 2(X_{3,3}+BX_{2,1} \\
& + EX_{3,1}+GX_{4,1})n_in_j + 2(X_{4,4}+CX_{2,1}-(D+E)X_{3,1} \\
& - (F+G)X_{4,1})p_ip_j + (X_{1,2}+X_{2,1})(l_im_j+l_jm_i) + (X_{1,3}+X_{3,1})(l_in_j \\
& + l_jn_i) + (X_{1,4}+X_{4,1})(l_ip_j+l_jp_i) + (m_in_j+m_jn_i)(X_{2,3}+X_{3,2}
\end{aligned}
$$

$$+2DX_{2,1}+2BX_{3,1}+2HX_{4,1})+(m_i p_j+m_j p_i)(X_{4,2}+X_{2,4}+2FX_{2,1}$$

$$+2HX_{3,1}+2CX_{4,1})+(n_i p_j+n_j p_i)(X_{4,3}+X_{3,4}+2HX_{2,1}$$

$$+2GX_{3,1}-2(D+E)X_{4,1}).$$

From $C^i_{jk}=g^{ih}C_{jkh}$ and (2.6), we have

$$LC^i_{jk}=A(m^i m_j m_k)+B(m^i n_j n_k+n^i m_j n_k+n^i n_j m_k)$$

$$+C(m^i p_j p_k+p^i m_j p_k+p^i p_j m_k)+D(m^i m_j n_k+m^i n_j m_k+n^i m_j m_k)$$

(3.14) $$+E(n^i n_j n_k)+F(m^i m_j p_k+m^i p_j m_k+p^i m_j m_k)+G(n^i n_j p_k+n^i p_j n_k$$

$$+p^i n_j n_k)+H(m^i n_j p_k+m^i p_j n_k+n^i m_j p_k+n^i p_j m_k+p^i m_j n_k$$

$$+p^i n_j m_k)-(D+E)(n^i p_j p_k+p^i n_j p_k+p^i p_j n_k)-(F+G)(p^i p_j p_k).$$

Lie derivatives of main scalars are given by

$$£_x A=A_{|r}X^r+A|_r w^r=A_{|r}X_\alpha e^r_{\alpha)}+A|_r LX_{\alpha,1}e^r_{\alpha)}=A_{,\alpha}X_\alpha+A_{;\alpha}X_{\alpha,1},$$

(3.15)

$$£_x B=B_{,\alpha}X_\alpha+B_{;\alpha}X_{\alpha,1},\qquad £_x C=C_{,\alpha}X_\alpha+C_{;\alpha}X_{\alpha,1},$$

$$£_x D=D_{,\alpha}X_\alpha+D_{;\alpha}X_{\alpha,1},\qquad £_x E=E_{,\alpha}X_\alpha+E_{;\alpha}X_{\alpha,1},$$

$$£_x F=F_{,\alpha}X_\alpha+F_{;\alpha}X_{\alpha,1},\qquad £_x G=G_{,\alpha}X_\alpha+G_{;\alpha}X_{\alpha,1},$$

$$£_x H=H_{,\alpha}X_\alpha+H_{;\alpha}X_{\alpha,1},$$

where $A_{,\alpha}$ and $A_{;\alpha}$ are the scalar components of $A_{|r}$ and $LA|_r$ respectively.

Now the Lie derivative of LC^i_{jk} is given by

$$£_x(LC^i_{jk})=£_x[A(m^i m_j m_k)+B(m^i n_j n_k+n^i m_j n_k+n^i n_j m_k)$$

$$+C(m^i_j p_k p+p^i_j m_k p+p^i_j p_k m)+D(m^i_j m_k n$$

(3.16) $$+m^i n_j m_k+n^i m_j m_k)+E(n^i n_j n_k)+F(m^i m_j p_k+m^i p_j m_k$$

$$+p^i m_j m_k)+G(n^i n_j p_k+n^i p_j n_k+p^i n_j n_k)+H(m^i n_j p_k$$

$$+m^i p_j n_k+n^i m_j p_k+n^i p_j m_k+p^i m_j n_k+p^i n_j m_k)$$

$$-(D+E)(n^i p_j p_k+p^i n_j p_k+p^i p_j n_k)-(F+G)(p^i p_j p_k)]$$

$$= (A_{,\alpha} X_\alpha + A_{;\alpha} X_{\alpha,1}) m^i m_j m_k - A(X_{1,2} + X_{2,1}) l^i m_j m_k + A(X_\alpha h_\alpha$$

$$+ X_{\alpha,1} u_\alpha - X_{3,2} - DX_{2,1} - BX_{3,1} - HX_{4,1}) n^i m_j m_k - A(X_\alpha j_\alpha + X_{\alpha,1} v_\alpha$$

$$+ X_{4,2} + FX_{2,1} + HX_{3,1} + CX_{4,1}) p^i m_j m_k + A(X_{2,2} + AX_{2,1} + DX_{3,1}$$

$$+ FX_{4,1}) m^i m_j m_k + A(X_\alpha h_\alpha + X_{\alpha,1} u_\alpha + X_{2,3} + DX_{2,1} + BX_{3,1}$$

$$+ HX_{4,1}) m^i n_j m_k + A(-X_\alpha j_\alpha - X_{\alpha,1} v_\alpha + X_{2,4} + FX_{2,1} + HX_{3,1}$$

$$+ CX_{4,1}) m^i p_j m_k + A(X_\alpha h_\alpha + X_{\alpha,1} u_\alpha + X_{2,3} + DX_{2,1} + BX_{3,1}$$

$$+ HX_{4,1}) m^i m_j n_k + A(-X_\alpha j_\alpha - X_{\alpha,1} v_\alpha + X_{2,4} + FX_{2,1} + HX_{3,1}$$

$$+ CX_{4,1}) m^i m_j p_k + (B_{,\alpha} X_\alpha + B_{;\alpha} X_{\alpha,1}) m^i n_j n_k - B(X_{1,2} + X_{2,1}) l^i n_j n_k$$

$$- B(X_{2,2} + AX_{2,1} + DX_{3,1} + FX_{4,1}) m^i n_j n_k + B(X_\alpha h_\alpha + X_{\alpha,1} u_\alpha$$

$$- X_{3,2} - DX_{2,1} - BX_{3,1} - HX_{4,1}) n^i n_j n_k - B(X_\alpha j_\alpha + X_{\alpha,1} v_\alpha + X_{4,2}$$

$$+ FX_{2,1} + HX_{3,1} + CX_{4,1}) p^i n_j n_k + B(-X_\alpha h_\alpha - X_{\alpha,1} u_\alpha + X_{3,2} + DX_{2,1}$$

$$+ BX_{3,1} + HX_{4,1}) m^i m_j n_k + 2B(X_{3,3} + BX_{2,1} + EX_{3,1} + GX_{4,1}) m^i n_j n_k$$

$$+ B(X_\alpha k_\alpha + X_{\alpha,1} w_\alpha + X_{3,4} + HX_{2,1} + GX_{3,1} - (D+E) X_{4,1}) m^i p_j n_k$$

$$+ B(-X_\alpha h_\alpha - X_{\alpha,1} u_\alpha + X_{3,2} + DX_{2,1} + BX_{3,1} + HX_{4,1}) m^i n_j m_k$$

$$+ B(X_\alpha k_\alpha + X_{\alpha,1} w_\alpha + X_{3,4} + HX_{2,1} + GX_{3,1} - (D+E) X_{4,1}) m^i n_j p_k$$

$$+ (B_{,\alpha} X_\alpha + B_{;\alpha} X_{\alpha,1}) n^i m_j n_k - B(X_{1,3} + X_{3,1}) l^i m_j n_k - B(X_\alpha h_\alpha$$

$$+ X_{\alpha,1} u_\alpha + X_{2,3} + DX_{2,1} + BX_{3,1} + HX_{4,1}) m^i m_j n_k + B(X_\alpha k_\alpha$$

$$+ X_{\alpha,1} w_\alpha - X_{4,3} - HX_{2,1} - GX_{3,1} + (D+E) X_{4,1}) p^i m_j n_k$$

$$+ B(X_{2,2} + AX_{2,1} + DX_{3,1} + FX_{4,1}) n^i m_j n_k + B(X_\alpha h_\alpha + X_{\alpha,1} u_\alpha$$

$$+ X_{2,3} + DX_{2,1} + BX_{3,1} + HX_{4,1}) n^i n_j n_k + B(-X_\alpha j_\alpha - X_{\alpha,1} v_\alpha$$

$$+ X_{2,4} + FX_{2,1} + HX_{3,1} + CX_{4,1}) n^i p_j n_k + B(-X_\alpha h_\alpha - X_{\alpha,1} u_\alpha$$

$$+ X_{3,2} + DX_{2,1} + BX_{3,1} + HX_{4,1}) n^i m_j m_k + B(X_\alpha k_\alpha + X_{\alpha,1} w_\alpha$$

$$+ X_{3,4} + HX_{2,1} + GX_{3,1} - (D+E) X_{4,1}) n^i m_j p_k + (B_{,\alpha} X_\alpha$$

$$+B_{;\alpha}X_{\alpha,1})n^in_jm_k - B(X_{1,3} + X_{3,1})l^in_jm_k - B(X_\alpha h_\alpha + X_{\alpha,1}u_\alpha$$

$$+X_{2,3} + DX_{2,1} + BX_{3,1} + HX_{4,1})m^in_jm_k + B(X_\alpha k_\alpha + X_{\alpha,1}w_\alpha$$

$$-X_{4,3} - HX_{2,1} - GX_{3,1} + (D+E)X_{4,1})p^in_jm_k + B(-X_\alpha h_\alpha$$

$$-X_{\alpha,1}u_\alpha + X_{3,2} + DX_{2,1} + BX_{3,1} + HX_{4,1})n^im_jm_k + B(X_\alpha k_\alpha$$

$$+X_{\alpha,1}w_\alpha + X_{3,4} + HX_{2,1} + GX_{3,1} - (D+E)X_{4,1})n^ip_jm_k$$

$$+B(X_{2,2} + AX_{2,1} + DX_{3,1} + FX_{4,1})n^in_jm_k + B(X_\alpha h_\alpha + X_{\alpha,1}u_\alpha$$

$$+X_{2,3} + DX_{2,1} + BX_{3,1} + HX_{4,1})n^in_jn_k + B(-X_\alpha j_\alpha - X_{\alpha,1}v_\alpha$$

$$+X_{2,4} + FX_{2,1} + HX_{3,1} + CX_{4,1})n^in_jp_k + (C_{,\alpha}X_\alpha + C_{;\alpha}X_{\alpha,1})m^ip_jp_k$$

$$-C(X_{1,2} + X_{2,1})l^ip_jp_k - C(X_{2,2} + AX_{2,1} + DX_{3,1} + FX_{4,1})m^ip_jp_k$$

$$+C(X_\alpha h_\alpha + X_{\alpha,1}u_\alpha - X_{3,2} - DX_{2,1} - BX_{3,1} - HX_{4,1})n^ip_jp_k$$

$$-C(X_\alpha j_\alpha + X_{\alpha,1}v_\alpha + X_{4,2} + FX_{2,1} + HX_{3,1} + CX_{4,1})p^ip_jp_k$$

$$+C(X_\alpha j_\alpha + X_{\alpha,1}v_\alpha + X_{4,2} + FX_{2,1} + HX_{3,1} + CX_{4,1})m^im_jp_k$$

$$+2C(X_{4,4} + CX_{2,1} - (D+E)X_{3,1} - (F+G)X_{4,1})m^ip_jp_k + C(-X_\alpha k_\alpha$$

$$-X_{\alpha,1}w_\alpha + X_{4,3} + HX_{2,1} + GX_{3,1} - (D+E)X_{4,1})m^in_jp_k + C(X_\alpha j_\alpha$$

$$+X_{\alpha,1}v_\alpha + X_{4,2} + FX_{2,1} + HX_{3,1} + CX_{4,1})m^ip_jm_k + C(-X_\alpha k_\alpha$$

$$-X_{\alpha,1}w_\alpha + X_{4,3} + HX_{2,1} + GX_{3,1} - (D+E)X_{4,1})m^ip_jn_k$$

$$+(C_{,\alpha}X_\alpha + C_{;\alpha}X_{\alpha,1})p^im_jp_k - C(X_{1,4} + X_{4,1})l^im_jp_k + C(X_\alpha j_\alpha$$

$$+X_{\alpha,1}v_\alpha - X_{2,4} - FX_{2,1} - HX_{3,1} - CX_{4,1})m^im_jp_k - C(X_\alpha k_\alpha$$

$$+X_{\alpha,1}w_\alpha + X_{3,4} + HX_{2,1} + GX_{3,1} - (D+E)X_{4,1})n^im_jp_k + C(X_{2,2}$$

$$+AX_{2,1} + DX_{3,1} + FX_{4,1})p^im_jp_k + C(X_\alpha h_\alpha + X_{\alpha,1}u_\alpha + X_{2,3}$$

$$+DX_{2,1} + BX_{3,1} + HX_{4,1})p^in_jp_k + C(-X_\alpha j_\alpha - X_{\alpha,1}v_\alpha + X_{2,4}$$

$$+FX_{2,1} + HX_{3,1} + CX_{4,1})p^ip_jp_k + C(X_\alpha j_\alpha + X_{\alpha,1}v_\alpha$$

$$+X_{4,2}+FX_{2,1}+HX_{3,1}+CX_{4,1})p^im_jm_k+C(-X_\alpha k_\alpha-X_{\alpha,1}w_\alpha$$

$$+X_{4,3}+HX_{2,1}+GX_{3,1}-(D+E)X_{4,1})p^im_jn_k+(C_{,\alpha}X_\alpha$$

$$+C_{;\alpha}X_{\alpha,1})p^ip_jm_k-C(X_{1,4}+X_{4,1})l^ip_jm_k+C(X_\alpha j_\alpha+X_{\alpha,1}v_\alpha$$

$$-X_{2,4}-FX_{2,1}-HX_{3,1}-CX_{4,1})m^ip_jm_k-C(X_\alpha k_\alpha+X_{\alpha,1}w_\alpha$$

$$+X_{3,4}+HX_{2,1}+GX_{3,1}-(D+E)X_{4,1})n^ip_jm_k+C(X_\alpha j_\alpha$$

$$+X_{\alpha,1}v_\alpha+X_{4,2}+FX_{2,1}+HX_{3,1}+CX_{4,1})p^im_jm_k+C(-X_\alpha k_\alpha$$

$$-X_{\alpha,1}w_\alpha+X_{4,3}+HX_{2,1}+GX_{3,1}-(D+E)X_{4,1})p^in_jm_k+C(X_{2,2}$$

$$+AX_{2,1}+DX_{3,1}+FX_{4,1})p^ip_jm_k+C(X_\alpha h_\alpha+X_{\alpha,1}u_\alpha+X_{2,3}$$

$$+DX_{2,1}+BX_{3,1}+HX_{4,1})p^ip_jn_k+C(-X_\alpha j_\alpha-X_{\alpha,1}v_\alpha+X_{2,4}$$

$$+FX_{2,1}+HX_{3,1}+CX_{4,1})p^ip_jp_k+(D_{,\alpha}X_\alpha+D_{;\alpha}X_{\alpha,1})m^im_jn_k$$

$$-D(X_{1,2}+X_{2,1})l^im_jn_k+D(X_\alpha h_\alpha+X_{\alpha,1}u_\alpha-X_{3,2}-DX_{2,1}$$

$$-BX_{3,1}-HX_{4,1})n^im_jn_k-D(X_\alpha j_\alpha+X_{\alpha,1}v_\alpha+X_{4,2}+FX_{2,1}$$

$$+HX_{3,1}+CX_{4,1})p^im_jn_k+D(X_\alpha h_\alpha+X_{\alpha,1}u_\alpha+X_{2,3}+DX_{2,1}$$

$$+BX_{3,1}+HX_{4,1})m^in_jn_k+D(-X_\alpha j_\alpha-X_{\alpha,1}v_\alpha+X_{2,4}+FX_{2,1}$$

$$+HX_{3,1}+CX_{4,1})m^ip_jn_k+D(-X_\alpha h_\alpha-X_{\alpha,1}u_\alpha+X_{3,2}+DX_{2,1}$$

$$+BX_{3,1}+HX_{4,1})m^im_jm_k+D(X_{3,3}+BX_{2,1}+EX_{3,1}+GX_{4,1})m^im_jn_k$$

$$+D(X_\alpha k_\alpha+X_{\alpha,1}w_\alpha+X_{3,4}+HX_{2,1}+GX_{3,1}-(D+E)X_{4,1})m^im_jp_k$$

$$+(D_{,\alpha}X_\alpha+D_{;\alpha}X_{\alpha,1})m^in_jm_k-D(X_{1,2}+X_{2,1})l^in_jm_k+D(X_\alpha h_\alpha$$

$$+X_{\alpha,1}\mu_\alpha-X_{3,2}-DX_{2,1}-BX_{3,1}-HX_{4,1})n^in_jm_k-D(X_\alpha j_\alpha$$

$$+X_{\alpha,1}v_\alpha+X_{4,2}+FX_{2,1}+HX_{3,1}+CX_{4,1}p^in_jm_k+D(-X_\alpha h_\alpha$$

$$-X_{\alpha,1}\mu_\alpha+X_{3,2}+DX_{2,1}+BX_{3,1}+HX_{4,1})m^im_jm_k+D(X_{3,3}$$

$$+BX_{2,1}+EX_{3,1}+GX_{4,1})m^in_jm_k+D(X_\alpha k_\alpha+X_{\alpha,1}w_\alpha+X_{3,4}$$

$$+HX_{2,1}+GX_{3,1}-(D+E)X_{4,1})m^ip_jm_k+D(X_\alpha h_\alpha+X_{\alpha,1}u_\alpha$$

$$+X_{2,3}+DX_{2,1}+BX_{3,1}+HX_{4,1})m^in_jn_k+D(-X_\alpha j_\alpha-X_{\alpha,1}v_\alpha$$

$$+X_{2,4}+FX_{2,1}+HX_{3,1}+CX_{4,1})m^i n_j p_k+(D_{,\alpha}X_\alpha+D_{;\alpha}X_{\alpha,1})n^i m_j m_k$$
$$-D(X_{1,3}+X_{3,1})l^i m_j m_k-D(X_\alpha h_\alpha+X_{\alpha,1}u_\alpha+X_{2,3}+DX_{2,1}$$
$$+BX_{3,1}+HX_{4,1})m^i m_j m_k-D(X_{3,3}BX_{2,1}+EX_{3,1}+GX_{4,1})n^i m_j m_k$$
$$+D(X_\alpha k_\alpha+X_{\alpha,1}w_\alpha-X_{4,3}-HX_{2,1}-GX_{3,1}+(D+E)X_{4,1})p^i m_j m_k$$
$$+2D(X_{2,2}+AX_{2,1}+DX_{3,1}+FX_{4,1})n^i m_j m_k+D(X_\alpha h_\alpha+X_{\alpha,1}u_\alpha$$
$$+X_{2,3}+DX_{2,1}+BX_{3,1}+HX_{4,1})n^i n_j m_k+D(-X_\alpha j_\alpha-X_{\alpha,1}v_\alpha$$
$$+X_{2,4}+FX_{2,1}+HX_{3,1}+CX_{4,1})n^i p_j m_k+D(X_\alpha h_\alpha+X_{\alpha,1}u_\alpha$$
$$+X_{2,3}+DX_{2,1}+BX_{3,1}+HX_{4,1})n^i m_j n_k+D(-X_\alpha j_\alpha-X_{\alpha,1}v_\alpha$$
$$+X_{2,4}+FX_{2,1}+HX_{3,1}+CX_{4,1})n^i m_j p_k+(E_{,\alpha}X_\alpha+E_{;\alpha}X_{\alpha,1})n^i n_j n_k$$
$$-E(X_{1,3}+X_{3,1})l^i n_j n_k-E(X_\alpha h_\alpha+X_{\alpha,1}u_\alpha+X_{2,3}+DX_{2,1}$$
$$+BX_{3,1}+HX_{4,1})m^i n_j n_k+E(X_\alpha k_\alpha+X_{\alpha,1}w_\alpha-X_{4,3}-HX_{2,1}$$
$$-GX_{3,1}+(D+E)X_{4,1})p^i n_j n_k+E(-X_\alpha h_\alpha-X_{\alpha,1}u_\alpha+X_{3,2}$$
$$+DX_{2,1}+BX_{3,1}+HX_{4,1})n^i m_j n_k+E(X_\alpha k_\alpha+X_{\alpha,1}w_\alpha+X_{3,4}$$
$$+HX_{2,1}+GX_{3,1}-(D+E)X_{4,1})n^i p_j n_k+E(-X_\alpha h_\alpha-X_{\alpha,1}u_\alpha$$
$$+X_{3,2}+DX_{2,1}+BX_{3,1}+HX_{4,1})n^i n_j m_k+E(X_{3,3}+BX_{2,1}$$
$$+EX_{3,1}+GX_{4,1})n^i n_j n_k+E(X_\alpha k_\alpha+X_{\alpha,1}w_\alpha+X_{3,4}+HX_{2,1}$$
$$+GX_{3,1}-(D+E)X_{4,1})n^i n_j p_k+(F_{,\alpha}X_\alpha+F_{;\alpha}X_{\alpha,1})m^i m_j p_k$$
$$-F(X_{1,2}+X_{2,1})l^i m_j p_k+F(X_\alpha h_\alpha+X_{\alpha,1}u_\alpha-X_{3,2}-DX_{2,1}$$
$$-BX_{3,1}-HX_{4,1})n^i m_j p_k-F(X_\alpha j_\alpha+X_{\alpha,1}v_\alpha+X_{4,2}+FX_{2,1}$$
$$+HX_{3,1}+CX_{4,1})p^i m_j p_k+F(X_\alpha h_\alpha+X_{\alpha,1}u_\alpha+X_{2,3}+DX_{2,1}$$
$$+BX_{3,1}+HX_{4,1})m^i n_j p_k+F(-X_\alpha j_\alpha-X_{\alpha,1}v_\alpha+X_{2,4}+FX_{2,1}$$
$$+HX_{3,1}+CX_{4,1})m^i p_j p_k+F(X_\alpha j_\alpha+X_{\alpha,1}v_\alpha+X_{4,2}+FX_{2,1}$$

$$+HX_{3,1}+CX_{4,1})m^im_jm_k+F(X_{4,4}+CX_{2,1}-(D+E)X_{3,1}$$
$$-(F+G)X_{4,1})m^im_jp_k+F(-X_\alpha k_\alpha-X_{\alpha,1}w_\alpha+X_{4,3}+HX_{2,1}$$
$$+GX_{3,1}-(D+E)X_{4,1})m^im_jn_k+(F_{,\alpha}X_\alpha+F_{;\alpha}X_{\alpha,1})m^ip_jm_k$$
$$-F(X_{1,2}+X_{2,1})l^ip_jm_k+F(X_\alpha h_\alpha+X_{\alpha,1}u_\alpha-X_{3,2}-DX_{2,1}$$
$$-BX_{3,1}-HX_{4,1})n^ip_jm_k-F(X_\alpha j_\alpha+X_{\alpha,1}v_\alpha+X_{4,2}+FX_{2,1}$$
$$+HX_{3,1}+CX_{4,1})p^ip_jm_k+F(X_\alpha j_\alpha+X_{\alpha,1}v_\alpha+X_{4,2}+FX_{2,1}$$
$$+HX_{3,1}+CX_{4,1})m^im_jm_k+F(X_{4,4}+CX_{2,1}-(D+E)X_{3,1}$$
$$-(F+G)X_{4,1})m^ip_jm_k+F(-X_\alpha k_\alpha-X_{\alpha,1}w_\alpha+X_{4,3}+HX_{2,1}$$
$$+GX_{3,1}-(D+E)X_{4,1})m^in_jm_k+F(X_\alpha h_\alpha+X_{\alpha,1}u_\alpha+X_{2,3}$$
$$+DX_{2,1}+BX_{3,1}+HX_{4,1})m^ip_jn_k+F(-X_\alpha j_\alpha-X_{\alpha,1}v_\alpha+X_{2,4}$$
$$+FX_{2,1}+HX_{3,1}+CX_{4,1})m^ip_jp_k+(F_{,\alpha}X_\alpha+F_{;\alpha}X_{\alpha,1})p^im_jm_k$$
$$-F(X_{1,4}+X_{4,1})l^im_jm_k-F(X_{4,4}+CX_{2,1}-(D+E)X_{3,1}$$
$$-(F+G)X_{4,1})p^im_jm_k+F(X_\alpha j_\alpha+X_{\alpha,1}v_\alpha-X_{2,4}-FX_{2,1}$$
$$-HX_{3,1}-CX_{4,1})m^im_jm_k-F(X_\alpha k_\alpha+X_{\alpha,1}w_\alpha+X_{3,4}+HX_{2,1}$$
$$+GX_{3,1}-(D+E)X_{4,1})n^im_jm_k+2F(X_{2,2}+AX_{2,1}+DX_{3,1}$$
$$+FX_{4,1})p^im_jm_k+F(X_\alpha h_\alpha+X_{\alpha,1}u_\alpha+X_{2,3}+DX_{2,1}+BX_{3,1}$$
$$+HX_{4,1})p^in_jm_k+F(-X_\alpha j_\alpha-X_{\alpha,1}v_\alpha+X_{2,4}+FX_{2,1}+HX_{3,1}$$
$$+CX_{4,1})p^ip_jm_k+F(X_\alpha h_\alpha+X_{\alpha,1}u_\alpha+X_{2,3}+DX_{2,1}+BX_{3,1}$$
$$+HX_{4,1})p^im_jn_k+F(-X_\alpha j_\alpha-X_{\alpha,1}v_\alpha+X_{2,4}+FX_{2,1}+HX_{3,1}$$
$$+CX_{4,1})p^im_jp_k+(G_{,\alpha}X_\alpha+G_{;\alpha}X_{\alpha,1})n^in_jp_k-G(X_{1,3}$$
$$+X_{3,1})l^in_jp_k-G(X_\alpha h_\alpha+X_{\alpha,1}u_\alpha+X_{2,3}+DX_{2,1}+BX_{3,1}$$

$$+HX_{4,1})m^i n_j p_k + G(X_\alpha k_\alpha + X_{\alpha,1} w_\alpha - X_{4,3} - HX_{2,1} - GX_{3,1}$$

$$+(D+E)X_{4,1})p^i n_j p_k + G(-X_\alpha h_\alpha - X_{\alpha,1} u_\alpha + X_{3,2} + DX_{2,1}$$

$$+BX_{3,1} + HX_{4,1})n^i m_j p_k + G(X_\alpha k_\alpha + X_{\alpha,1} w_\alpha + X_{3,4} + HX_{2,1}$$

$$+GX_{3,1} - (D+E)X_{4,1})n^i p_j p_k + G(X_\alpha j_\alpha + X_{\alpha,1} v_\alpha + X_{4,2}$$

$$+FX_{2,1} + HX_{3,1} + CX_{4,1})n^i n_j m_k + G(X_{4,4} + CX_{2,1} - (D+E)X_{3,1}$$

$$-(F+G)X_{4,1})n^i n_j p_k + G(-X_\alpha k_\alpha - X_{\alpha,1} w_\alpha + X_{4,3} + HX_{2,1}$$

$$+GX_{3,1} - (D+E)X_{4,1})n^i n_j n_k + (G_{,\alpha} X_\alpha + G_{;\alpha} X_{\alpha,1})n^i p_j n_k$$

$$-G(X_{1,3} + X_{3,1})l^i p_j n_k - G(X_\alpha h_\alpha + X_{\alpha,1} u_\alpha + X_{2,3} + DX_{2,1}$$

$$+BX_{3,1} + HX_{4,1})m^i p_j n_k + G(X_\alpha k_\alpha + X_{\alpha,1} w_\alpha - X_{4,3} - HX_{2,1}$$

$$-GX_{3,1} + (D+E)X_{4,1})p^i p_j n_k + G(X_\alpha j_\alpha + X_{\alpha,1} v_\alpha + X_{4,2}$$

$$+FX_{2,1} + HX_{3,1} + CX_{4,1})n^i m_j n_k + G(X_{4,4} + CX_{2,1} - (D+E)X_{3,1}$$

$$-(F+G)X_{4,1})n^i p_j n_k + G(-X_\alpha k_\alpha - X_{\alpha,1} w_\alpha + X_{4,3} + HX_{2,1}$$

$$+GX_{3,1} - (D+E)X_{4,1})n^i n_j n_k + G(-X_\alpha h_\alpha - X_{\alpha,1} u_\alpha + X_{3,2}$$

$$+DX_{2,1} + BX_{3,1} + HX_{4,1})n^i p_j m_k + G(X_\alpha k_\alpha + X_{\alpha,1} w_\alpha + X_{3,4}$$

$$+HX_{2,1} + GX_{3,1} - (D+E)X_{4,1})n^i p_j p_k + (G_{,\alpha} X_\alpha + G_{;\alpha} X_{\alpha,1})p^i n_j n_k$$

$$-G(X_{1,4} + X_{4,1})l^i n_j n_k - G(X_{4,4} + CX_{2,1} - (D+E)X_{3,1}$$

$$-(F+G)X_{4,1})p^i n_j n_k + G(X_\alpha j_\alpha + X_{\alpha,1} v_\alpha - X_{2,4} - FX_{2,1}$$

$$-HX_{3,1} - CX_{4,1})m^i n_j n_k - G(X_\alpha k_\alpha + X_{\alpha,1} w_\alpha + X_{3,4} + HX_{2,1}$$

$$+GX_{3,1} - (D+E)X_{4,1})n^i n_j n_k + G(-X_\alpha h_\alpha - X_{\alpha,1} u_\alpha + X_{3,2}$$

$$+DX_{2,1} + BX_{3,1} + HX_{4,1})p^i m_j n_k + 2G(X_{3,3} + BX_{2,1} + EX_{3,1}$$

$$+GX_{4,1})p^i n_j n_k + G(X_\alpha k_\alpha + X_{\alpha,1} w_\alpha + X_{3,4} + HX_{2,1} + GX_{3,1}$$

$$-(D+E)X_{4,1})p^i p_j n_k + G(-X_\alpha h_\alpha - X_{\alpha,1} u_\alpha + X_{3,2} + DX_{2,1}$$

$$+BX_{3,1}+HX_{4,1})p^in_jm_k+G(X_\alpha k_\alpha+X_{\alpha,1}w_\alpha+X_{3,4}+HX_{2,1}$$

$$+GX_{3,1}-(D+E)X_{4,1})p^in_jp_k(H_{,\alpha}X_\alpha+H_{;\alpha}X_{\alpha,1})m^in_jp_k-H(X_{1,2}$$

$$+X_{2,1})l^in_jp_k-H(X_{2,2}+AX_{2,1}+DX_{3,1}+FX_{4,1})m^in_jp_k+H(X_\alpha h_\alpha$$

$$+X_{\alpha,1}u_\alpha-X_{3,2}-DX_{2,1}-BX_{3,1}-HX_{4,1})n^in_jp_k-H(X_\alpha j_\alpha$$

$$+X_{\alpha,1}v_\alpha+X_{4,2}+FX_{2,1}+HX_{3,1}+CX_{4,1})p^in_jp_k+H(-X_\alpha h_\alpha$$

$$-X_{\alpha,1}u_\alpha+X_{3,2}+DX_{2,1}+BX_{3,1}+HX_{4,1})m^im_jp_k+H(X_{3,3}$$

$$+BX_{2,1}+EX_{3,1}+GX_{4,1})m^in_jp_k+H[X_\alpha k_\alpha+X_{\alpha,1}w_\alpha+X_{3,4}$$

$$+HX_{2,1}+GX_{3,1}-(D+E)X_{4,1}]m^ip_jp_k+H(X_\alpha j_\alpha+X_{\alpha,1}v_\alpha$$

$$+X_{4,2}+FX_{2,1}+HX_{3,1}+CX_{4,1})m^in_jm_k+H(X_{4,4}+CX_{2,1}$$

$$-(D+E)X_{3,1}-(F+G)X_{4,1})m^in_jp_k+H(-X_\alpha k_\alpha-X_{\alpha,1}w_\alpha$$

$$+X_{4,3}+HX_{2,1}+GX_{3,1}-(D+E)X_{4,1})m^in_jn_k+(H_{,\alpha}X_\alpha$$

$$+H_{;\alpha}X_{\alpha,1})m^ip_jn_k-H(X_{1,2}+X_{2,1})l^ip_jn_k-H(X_{2,2}+AX_{2,1}$$

$$+DX_{3,1}+FX_{4,1})m^ip_jn_k+H(X_\alpha h_\alpha+X_{\alpha,1}u_\alpha-X_{3,2}-DX_{2,1}$$

$$-BX_{3,1}-HX_{4,1})n^ip_jn_k-H(X_\alpha j_\alpha+X_{\alpha,1}v_\alpha+X_{4,2}+FX_{2,1}$$

$$+HX_{3,1}+CX_{4,1})p^ip_jn_k+H(X_\alpha j_\alpha+X_{\alpha,1}v_\alpha+X_{4,2}+FX_{2,1}$$

$$+HX_{3,1}+CX_{4,1})m^im_jn_k+H(X_{4,4}+CX_{2,1}-(D+E)X_{3,1}$$

$$-(F+G)X_{4,1})m^ip_jn_k+H[-X_\alpha k_\alpha-X_{\alpha,1}w_\alpha+X_{4,3}+HX_{2,1}$$

$$+GX_{3,1}-(D+E)X_{4,1}]m^in_jn_k+H(-X_\alpha h_\alpha-X_{\alpha,1}u_\alpha+X_{3,2}$$

$$+DX_{2,1}+BX_{3,1}+HX_{4,1})m^ip_jm_k+H(X_{3,3}+BX_{2,1}+EX_{3,1}$$

$$+GX_{4,1})m^ip_jn_k+H(X_\alpha k_\alpha+X_{\alpha,1}w_\alpha+X_{3,4}+HX_{2,1}+GX_{3,1}$$

$$-(D+E)X_{4,1})m^ip_jp_k+(H_{,\alpha}X_\alpha+H_{;\alpha}X_{\alpha,1})n^im_jp_k-H(X_{1,3}$$

$$+X_{3,1})l^im_jp_k-H(X_\alpha h_\alpha+X_{\alpha,1}u_\alpha+X_{2,3}+DX_{2,1}+BX_{3,1}$$

$$+HX_{4,1})m^im_jp_k-H(X_{3,3}+BX_{2,1}+EX_{3,1}+GX_{4,1})n^im_jp_k$$

$$+H(X_\alpha k_\alpha+X_{\alpha,1}w_\alpha-X_{4,3}-HX_{2,1}-GX_{3,1}+(D+E)X_{4,1})p^im_jp_k$$

$$+H(X_{2,2}+AX_{2,1}+DX_{3,1}+FX_{4,1})n^i m_j p_k + H(X_\alpha h_\alpha + X_{\alpha,1} u_\alpha$$
$$+X_{2,3}+DX_{2,1}+BX_{3,1}+HX_{4,1})n^i n_j p_k + H(-X_\alpha j_\alpha - X_{\alpha,1} v_\alpha$$
$$+X_{2,4}+FX_{2,1}+HX_{3,1}+CX_{4,1})n^i p_j p_k + H(X_\alpha j_\alpha + X_{\alpha,1} v_\alpha$$
$$+X_{4,2}+FX_{2,1}+HX_{3,1}+CX_{4,1})n^i m_j m_k + H(X_{4,4}+CX_{2,1}$$
$$-(D+E)X_{3,1}-(F+G)X_{4,1})n^i m_j p_k + H(-X_\alpha k_\alpha - X_{\alpha,1} w_\alpha$$
$$+X_{4,3}+HX_{2,1}+GX_{3,1}-(D+E)X_{4,1})n^i m_j n_k + (H_{,\alpha} X_\alpha$$
$$+H_{;\alpha} X_{\alpha,1})n^i p_j m_k - H(X_{1,3}+X_{3,1})l^i p_j m_k - H(X_\alpha h_\alpha + X_{\alpha,1} u_\alpha$$
$$+X_{2,3}+DX_{2,1}+BX_{3,1}+HX_{4,1})m^i p_j m_k - H(X_{3,3}+BX_{2,1}$$
$$+EX_{3,1}+GX_{4,1})n^i p_j m_k + H(X_\alpha k_\alpha + X_{\alpha,1} w_\alpha - X_{4,3} - HX_{2,1}$$
$$-GX_{3,1}+(D+E)X_{4,1})p^i p_j m_k + H(X_\alpha j_\alpha + X_{\alpha,1} v_\alpha + X_{4,2}$$
$$+FX_{2,1}+HX_{3,1}+CX_{4,1})n^i m_j m_k + H(X_{4,4}+CX_{2,1}-(D+E)X_{3,1}$$
$$-(F+G)X_{4,1})n^i p_j m_k + H(-X_\alpha k_\alpha - X_{\alpha,1} w_\alpha + X_{4,3} + HX_{2,1}$$
$$+GX_{3,1}-(D+E)X_{4,1})n^i n_j m_k + H(X_{2,2}+AX_{2,1}+DX_{3,1}$$
$$+FX_{4,1})n^i p_j m_k + H(X_\alpha h_\alpha + X_{\alpha,1} u_\alpha + X_{2,3} + DX_{2,1} + BX_{3,1}$$
$$+HX_{4,1})n_i p_j n_k + H(-X_\alpha j_\alpha - X_{\alpha,1} v_\alpha + X_{2,4} + FX_{2,1} + HX_{3,1}$$
$$+CX_{4,1})n_i p_j p_k + (H_{,\alpha} X_\alpha + H_{;\alpha} X_{\alpha,1})p^i m_j n_k - H(X_{1,4}$$
$$+X_{4,1})l^i m_j n_k + H(X_{4,4}+CX_{2,1}-(D+E)X_{3,1}-(F+G)X_{4,1})p^i m_j n_k$$
$$+H(X_\alpha j_\alpha + X_{\alpha,1} v_\alpha - X_{2,4} - FX_{2,1} - HX_{3,1} - CX_{4,1})m^i m_j n_k$$
$$-H(X_\alpha k_\alpha + X_{\alpha,1} w_\alpha + X_{3,4} + HX_{2,1} + GX_{3,1} - (D+E)X_{4,1})n^i m_j n_k$$
$$+H(X_{2,2}+AX_{2,1}+DX_{3,1}+FX_{4,1})p^i m_j n_k + H(X_\alpha h_\alpha + X_{\alpha,1} u_\alpha$$
$$+X_{2,3}+DX_{2,1}+BX_{3,1}+HX_{4,1})p^i n_j n_k + H(-X_\alpha j_\alpha - X_{\alpha,1} v_\alpha$$
$$+X_{2,4}+FX_{2,1}+HX_{3,1}+CX_{4,1})p^i p_j n_k + H(-X_\alpha h_\alpha - X_{\alpha,1} u_\alpha + E_{,\alpha} X_\alpha$$

$$+E_{;\alpha}X_{\alpha,1})p^in_jp_k+(D+E)(X_{1,4}+X_{4,1})l^in_jp_k-(D+E)(X_\alpha j_\alpha$$

$$+X_{\alpha,1}v_\alpha-X_{2,4}-FX_{2,1}-HX_{3,1}-CX_{4,1})m^in_jp_k+(D+E)(X_\alpha k_\alpha$$

$$+X_{\alpha,1}w_\alpha+X_{3,4}+HX_{2,1}+GX_{3,1}-(D+E)X_{4,1})n^in_jp_k$$

$$-(D+E)(-X_\alpha h_\alpha-X_{\alpha,1}u_\alpha+X_{3,2}+DX_{2,1}+BX_{3,1}$$

$$+HX_{4,1})p^im_jp_k-(D+E)(X_{3,3}+BX_{2,1}+EX_{3,1}$$

$$+GX_{4,1})p^in_jp_k-(D+E)(X_\alpha k_\alpha+X_{\alpha,1}w_\alpha+X_{3,4}+HX_{2,1}$$

$$+GX_{3,1}-(D+E)X_{4,1})p^ip_jp_k-(D+E)(X_\alpha j_\alpha+X_{\alpha,1}v_\alpha$$

$$+X_{4,2}+FX_{2,1}+HX_{3,1}+CX_{4,1})p^in_jm_k-(D+E)(-X_\alpha k_\alpha$$

$$-X_{\alpha,1}w_\alpha+X_{4,3}+HX_{2,1}+GX_{3,1}-(D+E)X_{4,1})p^in_jn_k$$

$$-(D_{,\alpha}X_\alpha+D_{;\alpha}X_{\alpha,1}+E_{,\alpha}X_\alpha+E_{;\alpha}X_{\alpha,1})p^ip_jn_k$$

$$+(D+E)(X_{1,4}+X_{4,1})l^ip_jn_k-(D+E)(X_\alpha j_\alpha+X_{\alpha,1}v_\alpha$$

$$-X_{2,4}-FX_{2,1}-HX_{3,1}-CX_{4,1})m^ip_jn_k+(D+E)(X_\alpha k_\alpha$$

$$+X_{\alpha,1}w_\alpha+X_{3,4}+HX_{2,1}+GX_{3,1}-(D+E)X_{4,1})n^ip_jn_k$$

$$-(D+E)(X_\alpha j_\alpha+X_{\alpha,1}v_\alpha+X_{4,2}+FX_{2,1}+HX_{3,1}+CX_{4,1})p^im_jn_k$$

$$-(D+E)(-X_\alpha k_\alpha-X_{\alpha,1}w_\alpha+X_{4,3}+HX_{2,1}+GX_{3,1}$$

$$-(D+E)X_{4,1})p^in_jn_k-(D+E)(-X_\alpha h_\alpha-X_{\alpha,1}u_\alpha+X_{3,2}$$

$$+DX_{2,1}+BX_{3,1}+HX_{4,1})p^ip_jm_k-(D+E)(X_{3,3}+BX_{2,1}$$

$$+EX_{3,1}+GX_{4,1})p^ip_jn_k-(D+E)(X_\alpha k_\alpha+X_{\alpha,1}w_\alpha+X_{3,4}$$

$$+HX_{2,1}+GX_{3,1}-(D+E)X_{4,1})p^ip_jp_k-(F_{,\alpha}X_\alpha+F_{;\alpha}X_{\alpha,1}$$

$$+G_{,\alpha}X_\alpha+G_{;\alpha}X_{\alpha,1})p^ip_jp_k+(F+G)(X_{1,4}+X_{4,1})l^ip_jp_k$$

$$-(F+G)(X_\alpha j_\alpha+X_{\alpha,1}v_\alpha-X_{2,4}-FX_{2,1}-HX_{3,1}-CX_{4,1})m^ip_jp_k$$

$$+(F+G)(X_\alpha k_\alpha+X_{\alpha,1}w_\alpha+X_{3,4}+HX_{2,1}+GX_{3,1}$$

$$-(D+E)X_{4,1})n^i p_j p_k -(F+G)(X_\alpha j_\alpha + X_{\alpha,1} v_\alpha + X_{4,2} + FX_{2,1} + HX_{3,1}$$
$$+CX_{4,1}) p^i m_j p_k -(F+G)(-X_\alpha k_\alpha - X_{\alpha,1} w_\alpha + X_{4,3} + HX_{2,1} + GX_{3,1}$$
$$-(D+E)X_{4,1}) p^i n_j p_k -(F+G)(X_\alpha j_\alpha + X_{\alpha,1} v_\alpha + X_{4,2} + FX_{2,1} + HX_{3,1}$$
$$+CX_{4,1}) p^i p_j m_k -(F+G)(X_{4,4} + CX_{2,1} -(D+E)X_{3,1} -(F+G)X_{4,1}) p^i p_j p_k$$
$$-(F+G)(-X_\alpha k_\alpha - X_{\alpha,1} w_\alpha + X_{4,3} + HX_{2,1} + GX_{3,1} -(D+E)X_{4,1}) p^i p_j n_k$$

Let $B_{\alpha\beta\gamma}$ be the scalar components of $£_x (LC^i_{jk})$. Then we have

$$£_x (LC^i_{jk}) = B_{\alpha\beta\gamma}\, e^i_{\alpha)}\, e_{\beta)j}\, e_{\gamma)k}.$$

Obviously $B_{\alpha\beta\gamma} = B_{\alpha\gamma\beta}$ and from (3.16), we get

$$B_{\alpha\beta 1} = 0$$

$$B_{122} = -F(X_{1,4} + X_{4,1}) - D(X_{1,3} + X_{3,1}) - A(X_{1,2} + X_{2,1})$$

$$B_{123} = -2H(X_{1,4} + X_{4,1}) - 2D(X_{1,2} + X_{2,1}) - 2B(X_{1,3} + X_{3,1})$$

$$B_{124} = -2H(X_{1,3} + X_{3,1}) - 2F(X_{1,2} + X_{2,1}) - 2C(X_{1,4} + X_{4,1})$$

$$B_{133} = -G(X_{1,4} + X_{4,1}) - B(X_{1,2} + X_{2,1}) - E(X_{1,3} + X_{3,1})$$

$$B_{134} = 2(D+E)(X_{1,4} + X_{4,1}) - 2H(X_{1,2} + X_{2,1}) - 2G(X_{1,3} + X_{3,1})$$

$$B_{144} = (D+E)(X_{1,3} + X_{3,1}) - C(X_{1,2} + X_{2,1}) + (F+G)(X_{1,4} + X_{4,1})$$

$$B_{222} = F(3X_\alpha j_\alpha + 3X_{\alpha,1} v_\alpha + 2X_{4,2} - X_{2,4} + FX_{2,1} + HX_{3,1} + CX_{4,1})$$
$$+ D(-3X_\alpha h_\alpha - 3X_{\alpha,1} u_\alpha + 2X_{3,2} - X_{2,3} + DX_{2,1} + BX_{3,1}$$
$$+ HX_{4,1}) + (A_{,\alpha} X_\alpha + A_{;\alpha} X_{\alpha,1}) - A(X_{2,2} + AX_{2,1} + DX_{3,1} + FX_{4,1})$$

$$B_{223} = 2H(2X_\alpha j_\alpha + 2X_{\alpha,1} v_\alpha + X_{4,2} - X_{2,4}) + 2F(-X_\alpha k_\alpha$$
$$- X_{\alpha,1} w_\alpha + X_{4,3} + HX_{2,1} + GX_{3,1} - (D+E)X_{4,1}) + 2(D_{,\alpha} X_\alpha$$
$$+ D_{;\alpha} X_{\alpha,1}) + 2D(X_{3,3} + BX_{2,1} + EX_{3,1} + GX_{4,1}) + 2B(-X_\alpha h_\alpha$$
$$- X_{\alpha,1} u_\alpha + X_{3,2} + DX_{2,1} + BX_{3,1} + HX_{4,1}) + (2A - 2B)(X_\alpha h_\alpha$$
$$+ X_{\alpha,1} u_\alpha + X_{2,3} + DX_{2,1} + BX_{3,1} + HX_{4,1})$$

$$B_{224}=2H(-2X_\alpha h_\alpha-2X_{\alpha,1}u_\alpha+X_{3,2}-X_{2,3})+2F(X_{4,4}+CX_{2,1}$$
$$-(D+E)X_{3,1}-(F+G)X_{4,1})+2(F_{,\alpha}X_\alpha+F_{;\alpha}X_{\alpha,1})$$
$$+2D(X_\alpha k_\alpha+X_{\alpha,1}w_\alpha+X_{3,4}+HX_{2,1}+GX_{3,1}-(D+E)X_{4,1})$$
$$+2C(2X_\alpha j_\alpha+2X_{\alpha,1}v_\alpha+X_{4,2}-X_{2,4})+2A(-X_\alpha j_\alpha$$
$$-X_{\alpha,1}v_\alpha+X_{2,4}+FX_{2,1}+HX_{3,1}+CX_{4,1})$$

$$B_{233}=2H(-X_\alpha k_\alpha-X_{\alpha,1}w_\alpha+X_{4,3}+HX_{2,1}+GX_{3,1}-(D+E)X_{4,1})$$
$$+G(X_\alpha j_\alpha+X_{\alpha,1}v_\alpha-X_{2,4}-FX_{2,1}-HX_{3,1}-CX_{4,1})+2D(X_\alpha h_\alpha$$
$$-X_{\alpha,1}u_\alpha+X_{2,3}+DX_{2,1}+BX_{3,1}+HX_{4,1})+(B_{,\alpha}X_\alpha+B_{;\alpha}X_{\alpha,1})$$
$$-B(X_{2,2}+AX_{2,1}+DX_{3,1}+FX_{4,1})+2B(X_{3,3}+BX_{2,1}+EX_{3,1}$$
$$+GX_{4,1})-E(X_\alpha h_\alpha+X_{\alpha,1}u_\alpha+X_{2,3}+DX_{2,1}+BX_{3,1}+HX_{4,1})$$

$$B_{234}=-2(D+E)(X_\alpha j_\alpha+X_{\alpha,1}v_\alpha-X_{2,4}-FX_{2,1}-HX_{3,1}-CX_{4,1})$$
$$+2(H_{,\alpha}X_\alpha+H_{;\alpha}X_{\alpha,1})-2H(X_{2,2}+AX_{2,1}+DX_{3,1}+FX_{4,1})$$
$$+2H(X_{3,3}+BX_{2,1}+EX_{3,1}+GX_{4,1})+(B_{,\alpha}X_\alpha+B_{;\alpha}X_{\alpha,1})$$
$$+2H(X_{4,4}+CX_{2,1}-(D+E)X_{3,1}-(F+G)X_{4,1})$$
$$+(2F-2G)(X_\alpha h_\alpha+X_{\alpha,1}u_\alpha+X_{2,3}+DX_{2,1}+BX_{3,1}$$
$$+HX_{4,1})+2D(-X_\alpha j_\alpha-X_{\alpha,1}v_\alpha+X_{2,4}+FX_{2,1}+HX_{3,1}$$
$$+CX_{4,1})+2C(-X_\alpha k_\alpha-X_{\alpha,1}w_\alpha+X_{4,3}+HX_{2,1}$$
$$+GX_{3,1}-(D+E)X_{4,1})+2B(X_\alpha k_\alpha+X_{\alpha,1}w_\alpha$$
$$+X_{3,4}+HX_{2,1}+GX_{3,1}-(D+E)X_{4,1})$$

$$B_{244}=(D+E)(X_\alpha h_\alpha+X_{\alpha,1}u_\alpha+X_{2,3}+DX_{2,1}+BX_{3,1}+HX_{4,1})$$
$$+2H(X_\alpha k_\alpha+X_{\alpha,1}w_\alpha+X_{3,4}+HX_{2,1}+GX_{3,1}-(D+E)X_{4,1})$$
$$+2F(-X_\alpha j_\alpha-X_{\alpha,1}v_\alpha+X_{2,4}+FX_{2,1}+HX_{3,1}+CX_{4,1})$$
$$+(C_{,\alpha}X_\alpha+C_{;\alpha}X_{\alpha,1})-C(X_{2,2}+AX_{2,1}+DX_{3,1}+FX_{4,1})$$
$$+2C(X_{4,4}+CX_{2,1}-(D+E)X_{3,1}-(F+G)X_{4,1})-(F+G)(X_\alpha j_\alpha$$
$$+X_{\alpha,1}v_\alpha-X_{2,4}-FX_{2,1}-HX_{3,1}-CX_{4,1})$$

$$B_{322} = 2H(X_\alpha j_\alpha + X_{\alpha,1}v_\alpha + X_{4,2} + FX_{2,1} + HX_{3,1} + CX_{4,1}) - F(X_\alpha k_\alpha$$
$$+ X_{\alpha,1}w_\alpha + X_{3,4} + HX_{2,1} + GX_{3,1} - (D+E)X_{4,1}) + (D_{,\alpha} X_\alpha$$
$$+ D_{;\alpha} X_{\alpha,1}) - D(X_{3,3} + BX_{2,1} + EX_{3,1} + GX_{4,1}) + 2D(X_{2,2}$$
$$+ AX_{2,1} + DX_{3,1} + FX_{4,1}) + (A-2B)(X_\alpha h_\alpha + X_{\alpha,1}u_\alpha$$
$$- X_{3,2} - DX_{2,1} - BX_{3,1} - HX_{4,1})$$

$$B_{323} = 2H(-2X_\alpha k_\alpha - 2X_{\alpha,1}w_\alpha + X_{4,3} - X_{3,4}) + 2G(X_\alpha j_\alpha + X_{\alpha,1}v_\alpha$$
$$+ X_{4,2} + FX_{2,1} + HX_{3,1} + CX_{4,1}) + 2(B_{,\alpha} X_\alpha + B_{;\alpha} X_{\alpha,1})$$
$$+ 2D(2X_\alpha h_\alpha + 2X_{\alpha,1}u_\alpha + X_{2,3} - X_{3,2}) + 2B(X_{2,2} + AX_{2,1} + DX_{3,1}$$
$$+ FX_{4,1}) + 2E(-X_\alpha h_\alpha - X_{\alpha,1}u_\alpha + X_{3,2} + DX_{2,1} + BX_{3,1} + HX_{4,1})$$

$$B_{324} = -2(D+E)(X_\alpha j_\alpha + X_{\alpha,1}v_\alpha + X_{4,2} + FX_{2,1} + HX_{3,1} + CX_{4,1})$$
$$+ 2(H_{,\alpha} X_\alpha + H_{;\alpha} X_{\alpha,1}) - 2H(X_{3,3} + BX_{2,1} + EX_{3,1} + GX_{4,1})$$
$$+ 2H(X_{2,2} + AX_{2,1} + DX_{3,1} + FX_{4,1}) + 2H(X_{4,4} + CX_{2,1}$$
$$- (D+E)X_{3,1} - (F+G)X_{4,1}) + 2G(-X_\alpha h_\alpha - X_{\alpha,1}u_\alpha$$
$$+ X_{3,2} + DX_{2,1} + BX_{3,1} + HX_{4,1}) + 2F(X_\alpha h_\alpha + X_{\alpha,1}u_\alpha - X_{3,2}$$
$$- DX_{2,1} - BX_{3,1} - HX_{4,1}) + 2D(-X_\alpha j_\alpha - X_{\alpha,1}v_\alpha + X_{2,4} + FX_{2,1}$$
$$+ HX_{3,1} + CX_{4,1}) + (2B - 2C)(X_\alpha k_\alpha + X_{\alpha,1}w_\alpha + X_{3,4} + HX_{2,1}$$
$$+ GX_{3,1} - (D+E)X_{4,1})$$

$$B_{333} = G(-3X_\alpha k_\alpha - 3X_{\alpha,1}w_\alpha + 2X_{4,3} - X_{3,4} + HX_{2,1} + GX_{3,1}$$
$$- (D+E)X_{4,1}) + B(3X_\alpha h_\alpha + 3X_{\alpha,1}u_\alpha + 2X_{2,3} - X_{3,2}$$
$$+ DX_{2,1} + BX_{3,1} + HX_{4,1}) + (E_{,\alpha} X_\alpha + E_{;\alpha} X_{\alpha,1})$$
$$+ E(X_{3,3} + BX_{2,1} + EX_{3,1} + GX_{4,1})$$

$$B_{334} = 2(D+E)(2X_\alpha k_\alpha + 2X_{\alpha,1}w_\alpha + X_{3,4} - X_{4,3}) + 2H(2X_\alpha h_\alpha$$
$$+ 2X_{\alpha,1}u_\alpha + X_{2,3} - X_{3,2}) + 2(G_{,\alpha} X_\alpha + G_{;\alpha} X_{\alpha,1}) - 2H(X_{3,3}$$
$$+ BX_{2,1} + EX_{3,1} + GX_{4,1}) + 2H(X_{2,2} + AX_{2,1} + DX_{3,1} + FX_{4,1})$$

$$+2G(X_{4,4}+CX_{2,1}-(D+E)X_{3,1}-(F+G)X_{4,1})+2B(-X_\alpha j_\alpha$$

$$-X_{\alpha,1}v_\alpha+X_{2,4}+FX_{2,1}+HX_{3,1}+CX_{4,1})+2E(X_\alpha k_\alpha+X_{\alpha,1}w_\alpha$$

$$+X_{3,4}+HX_{2,1}+GX_{3,1}-(D+E)X_{4,1})$$

$$B_{344}=-(D_{,\alpha}X_\alpha+D_{;\alpha}X_{\alpha,1}+E_{,\alpha}X_\alpha+E_{;\alpha}X_{\alpha,1})+(D+E)(X_{3,3}$$

$$+BX_{2,1}+EX_{3,1}+GX_{4,1})-2(D+E)(X_{4,4}+CX_{2,1}$$

$$-(D+E)X_{3,1}-(F+G)X_{4,1})+2H(-X_\alpha j_\alpha-X_{\alpha,1}v_\alpha$$

$$+X_{2,4}+FX_{2,1}+HX_{3,1}+CX_{4,1})+C(X_\alpha h_\alpha+X_{\alpha,1}u_\alpha$$

$$-X_{3,2}-DX_{2,1}-BX_{3,1}-HX_{4,1})+(F+3G)(X_\alpha k_\alpha+X_{\alpha,1}w_\alpha$$

$$+X_{3,4}+HX_{2,1}+GX_{3,1}-(D+E)X_{4,1})$$

$$B_{422}=2H(-X_\alpha h_\alpha-X_{\alpha,1}u_\alpha+X_{3,2}+DX_{2,1}+BX_{3,1}+HX_{4,1})$$

$$+(F_{,\alpha}X_\alpha+F_{;\alpha}X_{\alpha,1})-F(X_{4,4}+CX_{2,1}-(D+E)X_{3,1}$$

$$-(F+G)X_{4,1})+2F(X_{2,2}+AX_{2,1}+DX_{3,1}+FX_{4,1})$$

$$+D(X_\alpha k_\alpha+X_{\alpha,1}w_\alpha-X_{4,3}-HX_{2,1}-GX_{3,1}+(D+E)X_{4,1})$$

$$+(2C-A)(X_\alpha j_\alpha+X_{\alpha,1}v_\alpha+X_{4,2}+FX_{2,1}+HX_{3,1}+CX_{4,1})$$

$$B_{423}=-2(2D+E)(X_\alpha j_\alpha+X_{\alpha,1}v_\alpha+X_{4,2}+FX_{2,1}+HX_{3,1}+CX_{4,1})$$

$$+2(H_{,\alpha}X_\alpha+H_{;\alpha}X_{\alpha,1})+2H(X_{2,2}+AX_{2,1}+DX_{3,1}+FX_{4,1})$$

$$-2H(X_{4,4}+CX_{2,1}-(D+E)X_{3,1}-(F+G)X_{4,1})+2H(X_{3,3}$$

$$+BX_{2,1}+EX_{3,1}+GX_{4,1})+2G(-X_\alpha h_\alpha-X_{\alpha,1}u_\alpha+X_{3,2}+DX_{2,1}$$

$$+BX_{3,1}+HX_{4,1})+2F(X_\alpha h_\alpha+X_{\alpha,1}u_\alpha+X_{2,3}+DX_{2,1}+BX_{3,1}$$

$$+HX_{4,1})+2C(-X_\alpha k_\alpha-X_{\alpha,1}w_\alpha+X_{4,3}+HX_{2,1}+GX_{3,1}$$

$$-(D+E)X_{4,1})+2B(X_\alpha k_\alpha+X_{\alpha,1}w_\alpha-X_{4,3}-HX_{2,1}$$

$$-GX_{3,1}+(D+E)X_{4,1})$$

$$B_{424}=-2(D+E)(-X_\alpha h_\alpha-X_{\alpha,1}u_\alpha+X_{3,2}+DX_{2,1}+BX_{3,1}+HX_{4,1})$$

$$+2H(2X_\alpha k_\alpha+2X_{\alpha,1}w_\alpha-X_{4,3}+X_{3,4})-2(2F+G)(X_\alpha j_\alpha$$

$$+X_{\alpha,1}v_{\alpha}+X_{4,2}+FX_{2,1}+HX_{3,1}+CX_{4,1})+2F(-X_{\alpha}j_{\alpha}$$

$$-X_{\alpha,1}v_{\alpha}+X_{2,4}+FX_{2,1}+HX_{3,1}+CX_{4,1})+2(C_{,\alpha}X_{\alpha}$$

$$+C_{;\alpha}X_{\alpha,1})+2C(X_{2,2}+AX_{2,1}+DX_{3,1}+FX_{4,1})$$

$$B_{433}=-2(D+E)(-X_{\alpha}k_{\alpha}-X_{\alpha,1}w_{\alpha}+X_{4,3}+HX_{2,1}+GX_{3,1}$$

$$-(D+E)X_{4,1})+2H(X_{\alpha}h_{\alpha}+X_{\alpha,1}u_{\alpha}+X_{2,3}+DX_{2,1}$$

$$+BX_{3,1}+HX_{4,1})+(G_{,\alpha}X_{\alpha}+G_{;\alpha}X_{\alpha,1})-G(X_{4,4}+CX_{2,1}$$

$$-(D+E)X_{3,1}-(F+G)X_{4,1})+2G(X_{3,3}+BX_{2,1}+EX_{3,1}$$

$$+GX_{4,1})-B(X_{\alpha}j_{\alpha}+X_{\alpha,1}v_{\alpha}+X_{4,2}+FX_{2,1}+HX_{3,1}+CX_{4,1})$$

$$+E(X_{\alpha}k_{\alpha}+X_{\alpha,1}w_{\alpha}-X_{4,3}-HX_{2,1}-GX_{3,1}+(D+E)X_{4,1})$$

$$B_{434}=-2(D_{,\alpha}X_{\alpha}+D_{;\alpha}X_{\alpha,1}+E_{,\alpha}X_{\alpha}+E_{;\alpha}X_{\alpha,1})-2(D+E)(X_{3,3}$$

$$+BX_{2,1}+EX_{3,1}+GX_{4,1})+2H(-2X_{\alpha}j_{\alpha}-2X_{\alpha,1}v_{\alpha}$$

$$+X_{2,4}-X_{4,2})+2G(2X_{\alpha}k_{\alpha}+2X_{\alpha,1}w_{\alpha}-X_{4,3}+X_{3,4})$$

$$+2C(X_{\alpha}h_{\alpha}+X_{\alpha,1}u_{\alpha}+X_{2,3}+DX_{2,1}+BX_{3,1}+HX_{4,1})$$

$$-2(F+G)(-X_{\alpha}k_{\alpha}-X_{\alpha,1}w_{\alpha}+X_{4,3}+HX_{2,1}+GX_{3,1}$$

$$-(D+E)X_{4,1})$$

$$B_{444}=-(D+E)(3X_{\alpha}k_{\alpha}+3X_{\alpha,1}w_{\alpha}-X_{4,3}+2X_{3,4}+HX_{2,1}$$

$$+GX_{3,1}-(D+E)X_{4,1})-C(X_{\alpha}j_{\alpha}+X_{\alpha,1}v_{\alpha}+X_{4,2}$$

$$+FX_{2,1}+HX_{3,1}+CX_{4,1})-(F_{,\alpha}X_{\alpha}+F_{;\alpha}X_{\alpha,1}+G_{,\alpha}X_{\alpha}$$

$$+G_{;\alpha}X_{\alpha,1})-(F+G)(X_{4,4}+CX_{2,1}-(D+E)X_{3,1}-(F+G)X_{4,1})$$

$$+2C(-X_{\alpha}j_{\alpha}-X_{\alpha,1}v_{\alpha}+X_{2,4}+FX_{2,1}+HX_{3,1}+CX_{4,1})$$

4. Motion in Terms of Scalar Components

An infinitesimal transformation is said to be a motion if and only if [5]

$$\pounds_{x}g_{ij}=0.$$

Thus, the infinitesimal transformation (3.1) is a motion if and only if

$$
\begin{aligned}
& X_{1,1} = 0, \\
& X_{2,2} + AX_{2,1} + DX_{3,1} + FX_{4,1} = 0, \\
& X_{3,3} + BX_{2,1} + EX_{3,1} + GX_{4,1} = 0, \\
& X_{4,4} + CX_{2,1} - (D+E)X_{3,1} - (F+G)X_{4,1} = 0, \\
& X_{1,2} + X_{2,1} = 0, \\
& X_{1,3} + X_{3,1} = 0, \\
& X_{1,4} + X_{4,1} = 0, \\
& X_{2,3} + X_{3,2} + 2DX_{2,1} + 2BX_{3,1} + 2HX_{4,1} = 0, \\
& X_{4,2} + X_{2,4} + 2FX_{2,1} + 2HX_{3,1} + 2CX_{4,1} = 0, \\
& X_{4,3} + X_{3,4} + 2HX_{2,1} + 2GX_{3,1} - 2(D+E)X_{4,1} = 0.
\end{aligned}
\tag{4.1}
$$

Thus, we have

Theorem 4.1: The infinitesimal transformation (3.1) is a motion in four dimensional Finsler space if and only if (4.1) holds.

In view of Theorem 4.1, if the infinitesimal transformation (3.1) is a motion then the scalar components of the Lie derivative of LC^i_{jk} are

$$
\begin{aligned}
& B_{122} = 0, && B_{123} = 0, \\
& B_{124} = 0, && B_{133} = 0, \\
& B_{134} = 0, && B_{144} = 0,
\end{aligned}
$$

$$
\begin{aligned}
B_{222} = {} & 3F(X_\alpha j_\alpha + X_{\alpha,1}v_\alpha + \tfrac{1}{2}X_{4,2} - \tfrac{1}{2}X_{2,4}) \\
& - 3D(X_\alpha h_\alpha + X_{\alpha,1}u_\alpha + \tfrac{1}{2}X_{2,3} - \tfrac{1}{2}X_{3,2}) + (A_{,\alpha}X_\alpha + A_{;\alpha}X_{\alpha,1}), \\
B_{223} = {} & 4H(X_\alpha j_\alpha + X_{\alpha,1}v_\alpha + \tfrac{1}{2}X_{4,2} - \tfrac{1}{2}X_{2,4}) \\
& - 2F(X_\alpha k_\alpha + X_{\alpha,1}w_\alpha + \tfrac{1}{2}X_{3,4} - \tfrac{1}{2}X_{4,3}) + 2(D_{,\alpha}X_\alpha \\
& + D_{;\alpha}X_{\alpha,1}) - 4B(X_\alpha h_\alpha + X_{\alpha,1}u_\alpha + \tfrac{1}{2}X_{2,3} - \tfrac{1}{2}X_{3,2}) \\
& + 2A(X_\alpha h_\alpha + X_{\alpha,1}u_\alpha + \tfrac{1}{2}X_{2,3} - \tfrac{1}{2}X_{3,2}),
\end{aligned}
$$

$$B_{224} = -4H(X_\alpha h_\alpha + X_{\alpha,1}u_\alpha + \tfrac{1}{2}X_{2,3} - \tfrac{1}{2}X_{3,2}) + 2(F_{,\alpha}X_\alpha + F_{;\alpha}X_{\alpha,1})$$
$$+ 2D(X_\alpha k_\alpha + X_{\alpha,1}w_\alpha + \tfrac{1}{2}X_{3,4} - \tfrac{1}{2}X_{4,3}) + 4C(X_\alpha j_\alpha + X_{\alpha,1}v_\alpha$$
$$+ \tfrac{1}{2}X_{4,2} - \tfrac{1}{2}X_{2,4}) - 2A(X_\alpha j_\alpha + X_{\alpha,1}v_\alpha + \tfrac{1}{2}X_{4,2} - \tfrac{1}{2}X_{2,4}),$$

$$B_{233} = -2H(X_\alpha k_\alpha + X_{\alpha,1}w_\alpha + \tfrac{1}{2}X_{3,4} - \tfrac{1}{2}X_{4,3}) + G(X_\alpha j_\alpha$$
$$+ X_{\alpha,1}v_\alpha + \tfrac{1}{2}X_{4,2} - \tfrac{1}{2}X_{2,4}) + (2D - E)(X_\alpha h_\alpha - X_{\alpha,1}u_\alpha$$
$$+ \tfrac{1}{2}X_{2,3} - \tfrac{1}{2}X_{3,2}) + (B_{,\alpha}X_\alpha + B_{;\alpha}X_{\alpha,1}),$$

$$B_{234} = -2(2D + E)(X_\alpha j_\alpha + X_{\alpha,1}v_\alpha + \tfrac{1}{2}X_{4,2} - \tfrac{1}{2}X_{2,4}) + 2(H_{,\alpha}X_\alpha$$
$$+ H_{;\alpha}X_{\alpha,1}) + (B_{,\alpha}X_\alpha + B_{;\alpha}X_{\alpha,1}) + (2F - 2G)(X_\alpha h_\alpha$$
$$+ X_{\alpha,1}u_\alpha + \tfrac{1}{2}X_{2,3} - \tfrac{1}{2}X_{3,2}) - 2C(X_\alpha k_\alpha + X_{\alpha,1}w_\alpha + \tfrac{1}{2}X_{3,4}$$
$$- \tfrac{1}{2}X_{4,3}) + 2B(X_\alpha k_\alpha + X_{\alpha,1}w_\alpha + \tfrac{1}{2}X_{3,4} - \tfrac{1}{2}X_{4,3}),$$

$$B_{244} = (D + E)(X_\alpha h_\alpha + X_{\alpha,1}u_\alpha + \tfrac{1}{2}X_{2,3} - \tfrac{1}{2}X_{3,2}) + 2H(X_\alpha k_\alpha$$
$$+ X_{\alpha,1}w_\alpha + \tfrac{1}{2}X_{3,4} - \tfrac{1}{2}X_{4,3}) + (C_{,\alpha}X_\alpha + C_{;\alpha}X_{\alpha,1})$$
$$- (3F + G)(X_\alpha j_\alpha + X_{\alpha,1}v_\alpha - \tfrac{1}{2}X_{2,4} + \tfrac{1}{2}X_{4,2}),$$

$$B_{322} = 2H(X_\alpha j_\alpha + X_{\alpha,1}v_\alpha + \tfrac{1}{2}X_{4,2} - \tfrac{1}{2}X_{2,4}) - F(X_\alpha k_\alpha$$
$$+ X_{\alpha,1}w_\alpha + \tfrac{1}{2}X_{3,4} - \tfrac{1}{2}X_{4,3}) + (D_{,\alpha}X_\alpha + D_{;\alpha}X_{\alpha,1})$$
$$+ (A - 2B)(X_\alpha h_\alpha + X_{\alpha,1}u_\alpha + \tfrac{1}{2}X_{2,3} - \tfrac{1}{2}X_{3,2})$$

$$B_{323} = -4H(X_\alpha k_\alpha + X_{\alpha,1}w_\alpha + \tfrac{1}{2}X_{3,4} - \tfrac{1}{2}X_{4,3}) + 2G(X_\alpha j_\alpha$$
$$+ X_{\alpha,1}v_\alpha + \tfrac{1}{2}X_{4,2} - \tfrac{1}{2}X_{2,4}) + 2(B_{,\alpha}X_\alpha + B_{;\alpha}X_{\alpha,1})$$
$$- 2(2D - E)(X_\alpha h_\alpha + X_{\alpha,1}u_\alpha + \tfrac{1}{2}X_{2,3} - \tfrac{1}{2}X_{3,2})$$

$$B_{324} = -2(2D + E)(X_\alpha j_\alpha + X_{\alpha,1}v_\alpha + \tfrac{1}{2}X_{4,2} - \tfrac{1}{2}X_{2,4}) + 2(H_{,\alpha}X_\alpha$$
$$+ H_{;\alpha}X_{\alpha,1}) + 2(F - G)(X_\alpha h_\alpha + X_{\alpha,1}u_\alpha + \tfrac{1}{2}X_{2,3} - \tfrac{1}{2}X_{3,2})$$
$$+ 2(B - C)(X_\alpha k_\alpha + X_{\alpha,1}w_\alpha + \tfrac{1}{2}X_{3,4} - \tfrac{1}{2}X_{4,3})$$

$$B_{333} = -3G(X_\alpha k_\alpha + X_{\alpha,1}w_\alpha + \tfrac{1}{2}X_{3,4} - \tfrac{1}{2}X_{4,3}) + 3B(X_\alpha h_\alpha + X_{\alpha,1}u_\alpha$$
$$+ \tfrac{1}{2}X_{2,3} - \tfrac{1}{2}X_{3,2}) + (E_{,\alpha}X_\alpha + E_{;\alpha}X_{\alpha,1})$$

$$B_{334} = 2(2D+3E)(X_\alpha k_\alpha + X_{\alpha,1}w_\alpha + \tfrac{1}{2}X_{3,4} - \tfrac{1}{2}X_{4,3}) + 2(G_{,\alpha} X_\alpha + G_{;\alpha} X_{\alpha,1}) + 4H(X_\alpha h_\alpha + X_{\alpha,1}u_\alpha + \tfrac{1}{2}X_{2,3} - \tfrac{1}{2}X_{3,2}) - 2B(X_\alpha j_\alpha + X_{\alpha,1}v_\alpha + \tfrac{1}{2}X_{4,2} - \tfrac{1}{2}X_{2,4})$$

$$B_{344} = -(D_{,\alpha} X_\alpha + D_{;\alpha} X_{\alpha,1} + E_{,\alpha} X_\alpha + E_{;\alpha} X_{\alpha,1}) - 2H(X_\alpha j_\alpha + X_{\alpha,1}v_\alpha + \tfrac{1}{2}X_{4,2} - \tfrac{1}{2}X_{2,4}) + C(X_\alpha h_\alpha + X_{\alpha,1}u_\alpha + \tfrac{1}{2}X_{2,3} - \tfrac{1}{2}X_{3,2})$$

$$B_{422} = -2H(X_\alpha h_\alpha + X_{\alpha,1}u_\alpha + \tfrac{1}{2}X_{2,3} - \tfrac{1}{2}X_{3,2}) + (F_{,\alpha} X_\alpha + F_{;\alpha} X_{\alpha,1}) + D(X_\alpha k_\alpha + X_{\alpha,1}w_\alpha + \tfrac{1}{2}X_{3,4} - \tfrac{1}{2}X_{4,3}) + (2C-A)(X_\alpha j_\alpha + X_{\alpha,1}v_\alpha + \tfrac{1}{2}X_{4,2} - \tfrac{1}{2}X_{2,4})$$

$$B_{423} = -2(2D+E)(X_\alpha j_\alpha + X_{\alpha,1}v_\alpha + \tfrac{1}{2}X_{4,2} - \tfrac{1}{2}X_{2,4}) + 2(H_{,\alpha} X_\alpha + H_{;\alpha} X_{\alpha,1}) + 2(F-G)(X_\alpha h_\alpha + X_{\alpha,1}u_\alpha + \tfrac{1}{2}X_{2,3} - \tfrac{1}{2}X_{3,2}) + 2(B-C)(X_\alpha k_\alpha + X_{\alpha,1}w_\alpha + \tfrac{1}{2}X_{3,4} - \tfrac{1}{2}X_{4,3})$$

$$B_{424} = 2(D+E)(X_\alpha h_\alpha + X_{\alpha,1}u_\alpha + \tfrac{1}{2}X_{2,3} - \tfrac{1}{2}X_{3,2}) + 4H(X_\alpha k_\alpha + X_{\alpha,1}w_\alpha + \tfrac{1}{2}X_{3,4} - \tfrac{1}{2}X_{4,3}) + 2(C_{,\alpha} X_\alpha + C_{;\alpha} X_{\alpha,1}) - 2(3F+G)(X_\alpha j_\alpha + X_{\alpha,1}v_\alpha + \tfrac{1}{2}X_{4,2} - \tfrac{1}{2}X_{2,4})$$

$$B_{433} = (2D+3E)(X_\alpha k_\alpha + X_{\alpha,1}w_\alpha + \tfrac{1}{2}X_{3,4} - \tfrac{1}{2}X_{4,3}) + (G_{,\alpha} X_\alpha + G_{;\alpha} X_{\alpha,1}) + 2H(X_\alpha h_\alpha + X_{\alpha,1}u_\alpha + \tfrac{1}{2}X_{2,3} - \tfrac{1}{2}X_{3,2}) - B(X_\alpha j_\alpha + X_{\alpha,1}v_\alpha + \tfrac{1}{2}X_{4,2} - \tfrac{1}{2}X_{2,4})$$

$$B_{434} = -2(D_{,\alpha} X_\alpha + D_{;\alpha} X_{\alpha,1} + E_{,\alpha} X_\alpha + E_{;\alpha} X_{\alpha,1}) + 2(F+3G)(X_\alpha k_\alpha + X_{\alpha,1}w_\alpha + \tfrac{1}{2}X_{3,4} - \tfrac{1}{2}X_{4,3}) - 4H(X_\alpha j_\alpha + X_{\alpha,1}v_\alpha + \tfrac{1}{2}X_{4,2} - \tfrac{1}{2}X_{2,4}) + 2C(X_\alpha h_\alpha + X_{\alpha,1}u_\alpha + \tfrac{1}{2}X_{2,3} - \tfrac{1}{2}X_{3,2})$$

$$B_{444} = -3(D+E)(X_\alpha k_\alpha + X_{\alpha,1}w_\alpha + \tfrac{1}{2}X_{3,4} - \tfrac{1}{2}X_{4,3}) - (F_{,\alpha} X_\alpha + F_{;\alpha} X_{\alpha,1} + G_{,\alpha} X_\alpha + G_{;\alpha} X_{\alpha,1}) - C(X_\alpha j_\alpha + X_{\alpha,1}v_\alpha + \tfrac{1}{2}X_{4,2} - \tfrac{1}{2}X_{2,4})$$

Since the Lie-derivative of LC^i_{jk} with respect to a motion vanishes identically, the scalar components $B_{\alpha\beta\gamma}$ of $£_X(LC^i_{jk})$ are zero. Therefore we must have

$$0 = 3FP - 3DQ + (A_{,\alpha} X_\alpha + A_{;\alpha} X_{\alpha,1}),$$

$$0 = 4HP - 2FR + 2(D_{,\alpha} X_\alpha + D_{;\alpha} X_{\alpha,1}) + (2A - 4B)Q,$$

$$0 = -4HQ + 2(F_{,\alpha} X_\alpha + F_{;\alpha} X_{\alpha,1}) + 2DR + (4C - 2A)P,$$

$$0 = -2HR + GP + (2D - E)Q + (B_{,\alpha} X_\alpha + B_{;\alpha} X_{\alpha,1}),$$

$$0 = -2(2D + E)P + 2(H_{,\alpha} X_\alpha + H_{;\alpha} X_{\alpha,1}) + (B_{,\alpha} X_\alpha + B_{;\alpha} X_{\alpha,1})$$
$$+ (2F - 2G)Q - 2CR + 2BR,$$

$$0 = (D + E)Q + 2HR + (C_{,\alpha} X_\alpha + C_{;\alpha} X_{\alpha,1}) - (3F + G)P,$$

$$0 = 2HP - FR + (D_{,\alpha} X_\alpha + D_{;\alpha} X_{\alpha,1}) + (A - 2B)Q$$

$$0 = -4HR + 2GP + 2(B_{,\alpha} X_\alpha + B_{;\alpha} X_{\alpha,1}) - 2(2D - E)Q$$

$$0 = -2(2D + E)P + 2(H_{,\alpha} X_\alpha + H_{;\alpha} X_{\alpha,1}) + 2(F - G)Q + 2(B - C)R$$

$$0 = -3GR + 3BQ + (E_{,\alpha} X_\alpha + E_{;\alpha} X_{\alpha,1})$$

$$0 = 2(2D + 3E)R + 2(G_{,\alpha} X_\alpha + G_{;\alpha} X_{\alpha,1}) + 4HQ - 2BP$$

$$0 = -(D_{,\alpha} X_\alpha + D_{;\alpha} X_{\alpha,1} + E_{,\alpha} X_\alpha + E_{;\alpha} X_{\alpha,1}) - 2HP + CQ$$

$$0 = -2HQ + (F_{,\alpha} X_\alpha + F_{;\alpha} X_{\alpha,1}) + DR + (2C - A)P$$

$$0 = -2(2D + E)P + 2(H_{,\alpha} X_\alpha + H_{;\alpha} X_{\alpha,1}) + 2(F - G)Q + 2(B - C)R$$

$$0 = 2(D + E)Q + 4HR + 2(C_{,\alpha} X_\alpha + C_{;\alpha} X_{\alpha,1}) - 2(3F + G)P$$

$$0 = (2D + 3E)R + (G_{,\alpha} X_\alpha + G_{;\alpha} X_{\alpha,1}) + 2HQ - BP$$

$$0 = -2(D_{,\alpha} X_\alpha + D_{;\alpha} X_{\alpha,1} + E_{,\alpha} X_\alpha + E_{;\alpha} X_{\alpha,1}) + 2(F + 3G)R$$
$$- 4HP + 2CQ$$

$$0 = -3(D + E)R - (F_{,\alpha} X_\alpha + F_{;\alpha} X_{\alpha,1} + G_{,\alpha} X_\alpha + G_{;\alpha} X_{\alpha,1}) - CP,$$

where

$$P = X_\alpha j_\alpha + X_{\alpha,1} v_\alpha + \tfrac{1}{2} X_{4,2} - \tfrac{1}{2} X_{2,4},$$

$$Q = X_\alpha h_\alpha + X_{\alpha,1} u_\alpha + \tfrac{1}{2} X_{2,3} - \tfrac{1}{2} X_{3,2},$$

$$R = X_\alpha k_\alpha + X_{\alpha,1} w_\alpha + \tfrac{1}{2} X_{3,4} - \tfrac{1}{2} X_{4,3}.$$

5. Conformal Motion in Terms of Scalar Components

An infinitesimal transformation is said to be a conformal motion if and only if there exists a scalar function $\Phi(x)$ such that

$$£_x g_{ij} = 2\Phi g_{ij}.$$

Thus, from (2.3) and (3.13) the infinitesimal transformation (3.1) is conformal motion if and only if

(5.1)
$$\begin{aligned}
&X_{1,1} = \Phi,\\
&X_{2,2} + AX_{2,1} + DX_{3,1} + FX_{4,1} = \Phi,\\
&X_{3,3} + BX_{2,1} + EX_{3,1} + GX_{4,1} = \Phi,\\
&X_{4,4} + CX_{2,1} - (D+E)X_{3,1} - (F+G)X_{4,1} = \Phi,\\
&X_{1,2} + X_{2,1} = 0,\\
&X_{1,3} + X_{3,1} = 0 X_{1,4} + X_{4,1} = 0,\\
&X_{2,3} + X_{3,2} + 2DX_{2,1} + 2BX_{3,1} + 2HX_{4,1} = 0,\\
&X_{4,2} + X_{2,4} + 2FX_{2,1} + 2HX_{3,1} + 2CX_{4,1} = 0,\\
&X_{4,3} + X_{3,4} + 2HX_{2,1} + 2GX_{3,1} - 2(D+E)X_{4,1} = 0.
\end{aligned}$$

Thus, we conclude:

Theorem 5.1: The infinitesimal transformation (3.1) is a conformal motion in a four dimensional Finsler space if and only if there exists a scalar function $\Phi(x)$ such that (5.1) holds.

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