

รายการอ้างอิง

ภาษาไทย

- รณชัย บำเพ็ญอยู่. การวัดสอบกล้องถ่ายภาพรูปสี่เหลี่ยม 500 อีแอล/เอ็มในสนาม.วิทยานิพนธ์ปริญญา
มหาบัณฑิต ภาควิชาวิศวกรรมสำรวจ บัณฑิตวิทยาลัย จุฬาลงกรณ์มหาวิทยาลัย, 2529.
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Photogrammetry and Remote Sensing. Vol. XXXI, Part B1. Vienna :138-143 University of
Newcastle,1996.

ภาคผนวก

Applications of Collinearity Eight Photo

INPUT Data From TextFile (*.txt)

Off[General::"spell1"]

Off[General::"spell"]

Dat=ReadList["C:\Thesis\SC50A4\Mtmtca4\D&C50A4f\D50A4f.txt",String,RecordLists → True];

cp=(Length[ReadList["C:\Thesis\SC50A4\Mtmtca4\D&C50A4f\D50A4f.txt",String]]-17)/9

Ed1=ReadList[StringToStream[Extract[Dat, {1,3}]],Number];

Ed2=ReadList[StringToStream[Extract[Dat, {1,4}]],Number];

Ed3=ReadList[StringToStream[Extract[Dat, {1,5}]],Number];

Ed4=ReadList[StringToStream[Extract[Dat, {1,6}]],Number];

Ed5=ReadList[StringToStream[Extract[Dat, {1,7}]],Number];

Ed6=ReadList[StringToStream[Extract[Dat, {1,8}]],Number];

Ed7=ReadList[StringToStream[Extract[Dat, {1,9}]],Number];

Ed8=ReadList[StringToStream[Extract[Dat, {1,10}]],Number];

Int=ReadList[StringToStream[Extract[Dat, {1,13}]],Number];

Ex=Join[Ed1,Ed2,Ed3,Ed4,Ed5,Ed6,Ed7,Ed8,Int];

(* Join[Ed1,Ed2,Ed3,Ed4,Ed5,Ed6,Ed7,Ed8,Int] ; Iterate 2 = Xa *)

Clear[Pc1,Pxy1,Pc2,Pxy2,Gc,Gxyz]

Pc1=Array[Pxy1,cp];Pc2=Array[Pxy2,cp];Pc3=Array[Pxy3,cp];Pc4=Array[Pxy4,cp];

Pc5=Array[Pxy5,cp];Pc6=Array[Pxy6,cp];Pc7=Array[Pxy7,cp];Pc8=Array[Pxy8,cp];

Gc=Array[Gxyz,cp];

For[i=1,i<cp+1,Pxy1[i]=Delete[ReadList[StringToStream[Extract[Dat, {1,i+15}]],Number],1];i++]

For[i=1,i<cp+1,Pxy2[i]=Delete[ReadList[StringToStream[Extract[Dat, {1,i+15+cp}]],Number],1];i++]

For[i=1,i<cp+1,Pxy3[i]=Delete[ReadList[StringToStream[Extract[Dat, {1,i+15+cp*2}]],Number],1];i++]

For[i=1,i<cp+1,Pxy4[i]=Delete[ReadList[StringToStream[Extract[Dat, {1,i+15+cp*3}]],Number],1];i++]

```

For[i=1,i<cp+1,Pxy5[i]=Delete[ReadList[StringToStream[Extract[Dat,{1,i+15+cp*4}]],Number],1];i++]
For[i=1,i<cp+1,Pxy6[i]=Delete[ReadList[StringToStream[Extract[Dat,{1,i+15+cp*5}]],Number],1];i++]
For[i=1,i<cp+1,Pxy7[i]=Delete[ReadList[StringToStream[Extract[Dat,{1,i+15+cp*6}]],Number],1];i++]
For[i=1,i<cp+1,Pxy8[i]=Delete[ReadList[StringToStream[Extract[Dat,{1,i+15+cp*7}]],Number],1];i++]

```

```

For[i=1,i<cp+1,Gxyz[i]=Delete[ReadList[StringToStream[Extract[Dat,{1,i+17+cp*8}]],Number],1];i++]

```

```

Print["Ext Parameter = "MatrixForm[Ex]," VtPV = "[VtPV]]

```

```

Print["Photo (mm) = "MatrixForm[Pho=Join[Pc1,Pc2,Pc3,Pc4,Pc5,Pc6,Pc7,Pc8]]," Ground
(m)"MatrixForm[Gc]]

```

Create Variable In ARRAY

```

Clear[Ext12,Ep12]

```

```

Ext12=Array[Ep12,Length[Ex]];

```

```

Clear[Gxc,Gyc,Gzc,Gxi,Gyi,Gzi]

```

```

Gxc=Array[Gxi,Length[Gc]];Gyc=Array[Gyi,Length[Gc]];Gzc=Array[Gzi,Length[Gc]];

```

```

Clear[Phx1,Phy1,Phx2,Phy2,Phx3,Phy3,Phx4,Phy4,Px1,Py1,Px2,Py2,Px3,Py3,Px4,Py4]

```

```

Clear[Phx5,Phy5,Phx6,Phy6,Phx7,Phy7,Phx8,Phy8,Px5,Py5,Px6,Py6,Px7,Py7,Px8,Py8]

```

```

Phx1=Array[Px1,cp];Phx2=Array[Px2,cp];Phx3=Array[Px3,cp];Phx4=Array[Px4,cp];

```

```

Phx5=Array[Px5,cp];Phx6=Array[Px6,cp];Phx7=Array[Px7,cp];Phx8=Array[Px8,cp];

```

```

Phy1=Array[Py1,cp];Phy2=Array[Py2,cp];Phy3=Array[Py3,cp];Phy4=Array[Py4,cp];

```

```

Phy5=Array[Py5,cp];Phy6=Array[Py6,cp];Phy7=Array[Py7,cp];Phy8=Array[Py8,cp];

```

```

Clear[Mtx1,Mty1,Mtx2,Mty2,Mtx3,Mty3,Mtx4,Mty4,mx1,my1,mx2,my2,mx3,my3,mx4,my4]

```

```

Clear[Mtx5,Mty5,Mtx6,Mty6,Mtx7,Mty7,Mtx8,Mty8,mx5,my5,mx6,my6,mx7,my7,mx8,my8]

```

```

Mtx1=Array[mx1,cp];Mtx2=Array[mx2,cp];Mtx3=Array[mx3,cp];Mtx4=Array[mx4,cp];

```

```

Mtx5=Array[mx5,cp];Mtx6=Array[mx6,cp];Mtx7=Array[mx7,cp];Mtx8=Array[mx8,cp];

```

```

Mty1=Array[my1,cp];Mty2=Array[my2,cp];Mty3=Array[my3,cp];Mty4=Array[my4,cp];

```

```

Mty5=Array[my5,cp];Mty6=Array[my6,cp];Mty7=Array[my7,cp];Mty8=Array[my8,cp];

```

```

Clear[Lbx1,Lby1,Lbx2,Lby2,Lbx3,Lby3,Lbx4,Lby4,Lx1,Ly1,Lx2,Ly2,Lx3,Ly3,Lx4,Ly4]
Clear[Lbx5,Lby5,Lbx6,Lby6,Lbx7,Lby7,Lbx8,Lby8,Lx5,Ly5,Lx6,Ly6,Lx7,Ly7,Lx8,Ly8]
Lbx1=Array[Lx1,cp];Lbx2=Array[Lx2,cp];Lbx3=Array[Lx3,cp];Lbx4=Array[Lx4,cp];
Lbx5=Array[Lx5,cp];Lbx6=Array[Lx6,cp];Lbx7=Array[Lx7,cp];Lbx8=Array[Lx8,cp];
Lby1=Array[Ly1,cp];Lby2=Array[Ly2,cp];Lby3=Array[Ly3,cp];Lby4=Array[Ly4,cp];
Lby5=Array[Ly5,cp];Lby6=Array[Ly6,cp];Lby7=Array[Ly7,cp];Lby8=Array[Ly8,cp];

```

Rotation Matrix

```

so1=Sin[Ep12[1]];sf1=Sin[Ep12[2]];sk1=Sin[Ep12[3]];
co1=Cos[Ep12[1]];cf1=Cos[Ep12[2]];ck1=Cos[Ep12[3]];
r11a=cf1*ck1;r12a=so1*sf1*ck1+co1*sk1;r13a=-co1*sf1*ck1+so1*sk1;
r21a=-cf1*sk1;r22a=-so1*sf1*sk1+co1*ck1;r23a=co1*sf1*sk1+so1*ck1;
r31a=sf1;r32a=-so1*cf1;r33a=co1*cf1;
so2=Sin[Ep12[7]];sf2=Sin[Ep12[8]];sk2=Sin[Ep12[9]];
co2=Cos[Ep12[7]];cf2=Cos[Ep12[8]];ck2=Cos[Ep12[9]];
r11b=cf2*ck2;r12b=so2*sf2*ck2+co2*sk2;r13b=-co2*sf2*ck2+so2*sk2;
r21b=-cf2*sk2;r22b=-so2*sf2*sk2+co2*ck2;r23b=co2*sf2*sk2+so2*ck2;
r31b=sf2;r32b=-so2*cf2;r33b=co2*cf2;
so3=Sin[Ep12[13]];sf3=Sin[Ep12[14]];sk3=Sin[Ep12[15]];
co3=Cos[Ep12[13]];cf3=Cos[Ep12[14]];ck3=Cos[Ep12[15]];
r11c=cf3*ck3;r12c=so3*sf3*ck3+co3*sk3;r13c=-co3*sf3*ck3+so3*sk3;
r21c=-cf3*sk3;r22c=-so3*sf3*sk3+co3*ck3;r23c=co3*sf3*sk3+so3*ck3;
r31c=sf3;r32c=-so3*cf3;r33c=co3*cf3;
so4=Sin[Ep12[19]];sf4=Sin[Ep12[20]];sk4=Sin[Ep12[21]];
co4=Cos[Ep12[19]];cf4=Cos[Ep12[20]];ck4=Cos[Ep12[21]];
r11d=cf4*ck4;r12d=so4*sf4*ck4+co4*sk4;r13d=-co4*sf4*ck4+so4*sk4;
r21d=-cf4*sk4;r22d=-so4*sf4*sk4+co4*ck4;r23d=co4*sf4*sk4+so4*ck4;
r31d=sf4;r32d=-so4*cf4;r33d=co4*cf4;

```

$so5 = \text{Sin}[\text{Ep12}[25]]$; $sf5 = \text{Sin}[\text{Ep12}[26]]$; $sk5 = \text{Sin}[\text{Ep12}[27]]$;
 $co5 = \text{Cos}[\text{Ep12}[25]]$; $cf5 = \text{Cos}[\text{Ep12}[26]]$; $ck5 = \text{Cos}[\text{Ep12}[27]]$;
 $r11e = cf5 * ck5$; $r12e = so5 * sf5 * ck5 + co5 * sk5$; $r13e = -co5 * sf5 * ck5 + so5 * sk5$;
 $r21e = -cf5 * sk5$; $r22e = -so5 * sf5 * sk5 + co5 * ck5$; $r23e = co5 * sf5 * sk5 + so5 * ck5$;
 $r31e = sf5$; $r32e = -so5 * cf5$; $r33e = co5 * cf5$;
 $so6 = \text{Sin}[\text{Ep12}[31]]$; $sf6 = \text{Sin}[\text{Ep12}[32]]$; $sk6 = \text{Sin}[\text{Ep12}[33]]$;
 $co6 = \text{Cos}[\text{Ep12}[31]]$; $cf6 = \text{Cos}[\text{Ep12}[32]]$; $ck6 = \text{Cos}[\text{Ep12}[33]]$;
 $r11f = cf6 * ck6$; $r12f = so6 * sf6 * ck6 + co6 * sk6$; $r13f = -co6 * sf6 * ck6 + so6 * sk6$;
 $r21f = -cf6 * sk6$; $r22f = -so6 * sf6 * sk6 + co6 * ck6$; $r23f = co6 * sf6 * sk6 + so6 * ck6$;
 $r31f = sf6$; $r32f = -so6 * cf6$; $r33f = co6 * cf6$;
 $so7 = \text{Sin}[\text{Ep12}[37]]$; $sf7 = \text{Sin}[\text{Ep12}[38]]$; $sk7 = \text{Sin}[\text{Ep12}[39]]$;
 $co7 = \text{Cos}[\text{Ep12}[37]]$; $cf7 = \text{Cos}[\text{Ep12}[38]]$; $ck7 = \text{Cos}[\text{Ep12}[39]]$;
 $r11g = cf7 * ck7$; $r12g = so7 * sf7 * ck7 + co7 * sk7$; $r13g = -co7 * sf7 * ck7 + so7 * sk7$;
 $r21g = -cf7 * sk7$; $r22g = -so7 * sf7 * sk7 + co7 * ck7$; $r23g = co7 * sf7 * sk7 + so7 * ck7$;
 $r31g = sf7$; $r32g = -so7 * cf7$; $r33g = co7 * cf7$;
 $so8 = \text{Sin}[\text{Ep12}[43]]$; $sf8 = \text{Sin}[\text{Ep12}[44]]$; $sk8 = \text{Sin}[\text{Ep12}[45]]$;
 $co8 = \text{Cos}[\text{Ep12}[43]]$; $cf8 = \text{Cos}[\text{Ep12}[44]]$; $ck8 = \text{Cos}[\text{Ep12}[45]]$;
 $r11h = cf8 * ck8$; $r12h = so8 * sf8 * ck8 + co8 * sk8$; $r13h = -co8 * sf8 * ck8 + so8 * sk8$;
 $r21h = -cf8 * sk8$; $r22h = -so8 * sf8 * sk8 + co8 * ck8$; $r23h = co8 * sf8 * sk8 + so8 * ck8$;
 $r31h = sf8$; $r32h = -so8 * cf8$; $r33h = co8 * cf8$;

Colinearity Condition Equation

$$F_{x1}[\{Xi1_Xo1_Yi1_Yo1_Zi1_Zo1_}\}] = (-\text{Ep12}[49] * ((r11a * (Xi1 - Xo1) + r12a * (Yi1 - Yo1) + r13a * (Zi1 - Zo1)) / (r31a * (Xi1 - Xo1) + r32a * (Yi1 - Yo1) + r33a * (Zi1 - Zo1))))$$

$$F_{y1}[\{Xi1_Xo1_Yi1_Yo1_Zi1_Zo1_}\}] = (-\text{Ep12}[49] * ((r21a * (Xi1 - Xo1) + r22a * (Yi1 - Yo1) + r23a * (Zi1 - Zo1)) / (r31a * (Xi1 - Xo1) + r32a * (Yi1 - Yo1) + r33a * (Zi1 - Zo1))))$$

$$F_{x2}[\{Xi2_Xo2_Yi2_Yo2_Zi2_Zo2_}\}] = (-\text{Ep12}[49] * ((r11b * (Xi2 - Xo2) + r12b * (Yi2 - Yo2) + r13b * (Zi2 - Zo2)) / (r31b * (Xi2 - Xo2) + r32b * (Yi2 - Yo2) + r33b * (Zi2 - Zo2))))$$

$$F_{y2}[\{Xi2_Xo2_Yi2_Yo2_Zi2_Zo2_}\}] = (-\text{Ep12}[49] * ((r21b * (Xi2 - Xo2) + r22b * (Yi2 - Yo2) + r23b * (Zi2 - Zo2)) / (r31b * (Xi2 - Xo2) + r32b * (Yi2 - Yo2) + r33b * (Zi2 - Zo2))))$$

$$F_{x3}[\{X_{i3}, X_{o3}, Y_{i3}, Y_{o3}, Z_{i3}, Z_{o3}\}] = (-Ep12[49] * ((r11c * (X_{i3} - X_{o3}) + r12c * (Y_{i3} - Y_{o3}) + r13c * (Z_{i3} - Z_{o3})) / (r31c * (X_{i3} - X_{o3}) + r32c * (Y_{i3} - Y_{o3}) + r33c * (Z_{i3} - Z_{o3}))))$$

$$F_{y3}[\{X_{i3}, X_{o3}, Y_{i3}, Y_{o3}, Z_{i3}, Z_{o3}\}] = (-Ep12[49] * ((r21c * (X_{i3} - X_{o3}) + r22c * (Y_{i3} - Y_{o3}) + r23c * (Z_{i3} - Z_{o3})) / (r31c * (X_{i3} - X_{o3}) + r32c * (Y_{i3} - Y_{o3}) + r33c * (Z_{i3} - Z_{o3}))))$$

$$F_{x4}[\{X_{i4}, X_{o4}, Y_{i4}, Y_{o4}, Z_{i4}, Z_{o4}\}] = (-Ep12[49] * ((r11d * (X_{i4} - X_{o4}) + r12d * (Y_{i4} - Y_{o4}) + r13d * (Z_{i4} - Z_{o4})) / (r31d * (X_{i4} - X_{o4}) + r32d * (Y_{i4} - Y_{o4}) + r33d * (Z_{i4} - Z_{o4}))))$$

$$F_{y4}[\{X_{i4}, X_{o4}, Y_{i4}, Y_{o4}, Z_{i4}, Z_{o4}\}] = (-Ep12[49] * ((r21d * (X_{i4} - X_{o4}) + r22d * (Y_{i4} - Y_{o4}) + r23d * (Z_{i4} - Z_{o4})) / (r31d * (X_{i4} - X_{o4}) + r32d * (Y_{i4} - Y_{o4}) + r33d * (Z_{i4} - Z_{o4}))))$$

$$F_{x5}[\{X_{i5}, X_{o5}, Y_{i5}, Y_{o5}, Z_{i5}, Z_{o5}\}] = (-Ep12[49] * ((r11e * (X_{i5} - X_{o5}) + r12e * (Y_{i5} - Y_{o5}) + r13e * (Z_{i5} - Z_{o5})) / (r31e * (X_{i5} - X_{o5}) + r32e * (Y_{i5} - Y_{o5}) + r33e * (Z_{i5} - Z_{o5}))))$$

$$F_{y5}[\{X_{i5}, X_{o5}, Y_{i5}, Y_{o5}, Z_{i5}, Z_{o5}\}] = (-Ep12[49] * ((r21e * (X_{i5} - X_{o5}) + r22e * (Y_{i5} - Y_{o5}) + r23e * (Z_{i5} - Z_{o5})) / (r31e * (X_{i5} - X_{o5}) + r32e * (Y_{i5} - Y_{o5}) + r33e * (Z_{i5} - Z_{o5}))))$$

$$F_{x6}[\{X_{i6}, X_{o6}, Y_{i6}, Y_{o6}, Z_{i6}, Z_{o6}\}] = (-Ep12[49] * ((r11f * (X_{i6} - X_{o6}) + r12f * (Y_{i6} - Y_{o6}) + r13f * (Z_{i6} - Z_{o6})) / (r31f * (X_{i6} - X_{o6}) + r32f * (Y_{i6} - Y_{o6}) + r33f * (Z_{i6} - Z_{o6}))))$$

$$F_{y6}[\{X_{i6}, X_{o6}, Y_{i6}, Y_{o6}, Z_{i6}, Z_{o6}\}] = (-Ep12[49] * ((r21f * (X_{i6} - X_{o6}) + r22f * (Y_{i6} - Y_{o6}) + r23f * (Z_{i6} - Z_{o6})) / (r31f * (X_{i6} - X_{o6}) + r32f * (Y_{i6} - Y_{o6}) + r33f * (Z_{i6} - Z_{o6}))))$$

$$F_{x7}[\{X_{i7}, X_{o7}, Y_{i7}, Y_{o7}, Z_{i7}, Z_{o7}\}] = (-Ep12[49] * ((r11g * (X_{i7} - X_{o7}) + r12g * (Y_{i7} - Y_{o7}) + r13g * (Z_{i7} - Z_{o7})) / (r31g * (X_{i7} - X_{o7}) + r32g * (Y_{i7} - Y_{o7}) + r33g * (Z_{i7} - Z_{o7}))))$$

$$F_{y7}[\{X_{i7}, X_{o7}, Y_{i7}, Y_{o7}, Z_{i7}, Z_{o7}\}] = (-Ep12[49] * ((r21g * (X_{i7} - X_{o7}) + r22g * (Y_{i7} - Y_{o7}) + r23g * (Z_{i7} - Z_{o7})) / (r31g * (X_{i7} - X_{o7}) + r32g * (Y_{i7} - Y_{o7}) + r33g * (Z_{i7} - Z_{o7}))))$$

$$F_{x8}[\{X_{i8}, X_{o8}, Y_{i8}, Y_{o8}, Z_{i8}, Z_{o8}\}] = (-Ep12[49] * ((r11h * (X_{i8} - X_{o8}) + r12h * (Y_{i8} - Y_{o8}) + r13h * (Z_{i8} - Z_{o8})) / (r31h * (X_{i8} - X_{o8}) + r32h * (Y_{i8} - Y_{o8}) + r33h * (Z_{i8} - Z_{o8}))))$$

$$F_{y8}[\{X_{i8}, X_{o8}, Y_{i8}, Y_{o8}, Z_{i8}, Z_{o8}\}] = (-Ep12[49] * ((r21h * (X_{i8} - X_{o8}) + r22h * (Y_{i8} - Y_{o8}) + r23h * (Z_{i8} - Z_{o8})) / (r31h * (X_{i8} - X_{o8}) + r32h * (Y_{i8} - Y_{o8}) + r33h * (Z_{i8} - Z_{o8}))))$$

Matrix A and Matrix L

For[i=1, i<cp+1, mx1[i]=Map[D[Fx1[{Gxc[[i]], Ep12[4], Gyc[[i]], Ep12[5], Gzc[[i]], Ep12[6]}], #]&, Ext12]; m

y1[i]=Map[D[Fy1[{Gxc[[i]], Ep12[4], Gyc[[i]], Ep12[5], Gzc[[i]], Ep12[6]}], #]&, Ext12]; i++]

For[i=1, i<cp+1, mx2[i]=Map[D[Fx2[{Gxc[[i]], Ep12[10], Gyc[[i]], Ep12[11], Gzc[[i]], Ep12

[12]}], #]&, Ext12]; my2[i]=Map[D[Fy2[{Gxc[[i]], Ep12[10], Gyc[[i]], Ep12[11], Gzc[[i]], Ep12

[12]}], #]&, Ext12]; i++]

```

For[i=1,i<cp+1,mx3[i]=Map[D[Fx3[{Gxc[[i]],Ep12[16],Gyc[[i]],Ep12[17],Gzc[[i]],Ep12
[18]}],#]&,Ext12];my3[i]=Map[D[Fy3[{Gxc[[i]],Ep12[16],Gyc[[i]],Ep12[17],Gzc[[i]],Ep12
[18]}],#]&,Ext12];i++]

For[i=1,i<cp+1,mx4[i]=Map[D[Fx4[{Gxc[[i]],Ep12[22],Gyc[[i]],Ep12[23],Gzc[[i]],Ep12
[24]}],#]&,Ext12];my4[i]=Map[D[Fy4[{Gxc[[i]],Ep12[22],Gyc[[i]],Ep12[23],Gzc[[i]],Ep12
[24]}],#]&,Ext12];i++]

For[i=1,i<cp+1,mx5[i]=Map[D[Fx5[{Gxc[[i]],Ep12[28],Gyc[[i]],Ep12[29],Gzc[[i]],Ep12
[30]}],#]&,Ext12];my5[i]=Map[D[Fy5[{Gxc[[i]],Ep12[28],Gyc[[i]],Ep12[29],Gzc[[i]],Ep12
[30]}],#]&,Ext12];i++]

For[i=1,i<cp+1,mx6[i]=Map[D[Fx6[{Gxc[[i]],Ep12[34],Gyc[[i]],Ep12[35],Gzc[[i]],Ep12
[36]}],#]&,Ext12];my6[i]=Map[D[Fy6[{Gxc[[i]],Ep12[34],Gyc[[i]],Ep12[35],Gzc[[i]],Ep12
[36]}],#]&,Ext12];i++]

For[i=1,i<cp+1,mx7[i]=Map[D[Fx7[{Gxc[[i]],Ep12[40],Gyc[[i]],Ep12[41],Gzc[[i]],Ep12
[42]}],#]&,Ext12];my7[i]=Map[D[Fy7[{Gxc[[i]],Ep12[40],Gyc[[i]],Ep12[41],Gzc[[i]],Ep12
[42]}],#]&,Ext12];i++]

For[i=1,i<cp+1,mx8[i]=Map[D[Fx8[{Gxc[[i]],Ep12[46],Gyc[[i]],Ep12[47],Gzc[[i]],Ep12
[48]}],#]&,Ext12];my8[i]=Map[D[Fy8[{Gxc[[i]],Ep12[46],Gyc[[i]],Ep12[47],Gzc[[i]],Ep12
[48]}],#]&,Ext12];i++]

For[i=1,i<cp+1,Lx1[i]=Fx1[{Gxc[[i]],Ep12[4],Gyc[[i]],Ep12[5],Gzc[[i]],Ep12[6]}];Ly1[i]=Fy1[{Gxc
[[i]],Ep12[4],Gyc[[i]],Ep12[5],Gzc[[i]],Ep12[6]}];i++]

For[i=1,i<cp+1,Lx2[i]=Fx2[{Gxc[[i]],Ep12[10],Gyc[[i]],Ep12[11],Gzc[[i]],Ep12[12]}];Ly2[i]=Fy2[{Gxc
[[i]],Ep12[10],Gyc[[i]],Ep12[11],Gzc[[i]],Ep12[12]}];i++]

For[i=1,i<cp+1,Lx3[i]=Fx3[{Gxc[[i]],Ep12[16],Gyc[[i]],Ep12[17],Gzc[[i]],Ep12[18]}];Ly3[i]=Fy3[{Gxc
[[i]],Ep12[16],Gyc[[i]],Ep12[17],Gzc[[i]],Ep12[18]}];i++]

For[i=1,i<cp+1,Lx4[i]=Fx4[{Gxc[[i]],Ep12[22],Gyc[[i]],Ep12[23],Gzc[[i]],Ep12[24]}];Ly4[i]=Fy4[{Gxc
[[i]],Ep12[22],Gyc[[i]],Ep12[23],Gzc[[i]],Ep12[24]}];i++]

For[i=1,i<cp+1,Lx5[i]=Fx5[{Gxc[[i]],Ep12[28],Gyc[[i]],Ep12[29],Gzc[[i]],Ep12[30]}];Ly5[i]=Fy5[{Gxc
[[i]],Ep12[28],Gyc[[i]],Ep12[29],Gzc[[i]],Ep12[30]}];i++]

For[i=1,i<cp+1,Lx6[i]=Fx6[{Gxc[[i]],Ep12[34],Gyc[[i]],Ep12[35],Gzc[[i]],Ep12[36]}];Ly6[i]=Fy6[{Gxc
[[i]],Ep12[34],Gyc[[i]],Ep12[35],Gzc[[i]],Ep12[36]}];i++]

```



```
For[i=1,i<cp+1,Lx7[i]=Fx7[{Gxc[[i]],Ep12[40],Gyc[[i]],Ep12[41],Gzc[[i]],Ep12[42]}];Ly7[i]=Fy7[{Gxc
[[i]],Ep12[40],Gyc[[i]],Ep12[41],Gzc[[i]],Ep12[42]}];i++]
```

```
For[i=1,i<cp+1,Lx8[i]=Fx8[{Gxc[[i]],Ep12[46],Gyc[[i]],Ep12[47],Gzc[[i]],Ep12[48]}];Ly8[i]=Fy8[{Gxc
[[i]],Ep12[46],Gyc[[i]],Ep12[47],Gzc[[i]],Ep12[48]}];i++]
```

Weight Matrix

```
Q = 1;
```

```
Rfv=1;
```

```
P=Rfv*Inverse[IdentityMatrix[cp*2*8]*Q];
```

In Place Of Matrix

```
For[i=1,i<Length[Ex]+1,Ep12[i]=Ex[[i]];i++]
```

```
For[i=1,i<cp+1,Gxi[i]=Gxyz[i][[1]];
```

```
  Gyi[i]=Gxyz[i][[2]];Gzi[i]=Gxyz[i][[3]];i++]
```

```
For[i=1,i<cp+1,Px1[i]=Pxy1[i][[1]];Py1[i]=Pxy1[i][[2]];i++]
```

```
For[i=1,i<cp+1,Px2[i]=Pxy2[i][[1]];Py2[i]=Pxy2[i][[2]];i++]
```

```
For[i=1,i<cp+1,Px3[i]=Pxy3[i][[1]];Py3[i]=Pxy3[i][[2]];i++]
```

```
For[i=1,i<cp+1,Px4[i]=Pxy4[i][[1]];Py4[i]=Pxy4[i][[2]];i++]
```

```
For[i=1,i<cp+1,Px5[i]=Pxy5[i][[1]];Py5[i]=Pxy5[i][[2]];i++]
```

```
For[i=1,i<cp+1,Px6[i]=Pxy6[i][[1]];Py6[i]=Pxy6[i][[2]];i++]
```

```
For[i=1,i<cp+1,Px7[i]=Pxy7[i][[1]];Py7[i]=Pxy7[i][[2]];i++]
```

```
For[i=1,i<cp+1,Px8[i]=Pxy8[i][[1]];Py8[i]=Pxy8[i][[2]];i++]
```

```
Matrix A1 = MatrixForm[A1=Partition[Flatten[Thread[{Mtx1,Mty1}]],49]/N];
```

```
Matrix A2 = MatrixForm[A2=Partition[Flatten[Thread[{Mtx2,Mty2}]],49]/N];
```

```
Matrix A3 = MatrixForm[A3=Partition[Flatten[Thread[{Mtx3,Mty3}]],49]/N];
```

```
Matrix A4 = MatrixForm[A4=Partition[Flatten[Thread[{Mtx4,Mty4}]],49]/N];
```

```
Matrix A5 = MatrixForm[A5=Partition[Flatten[Thread[{Mtx5,Mty5}]],49]/N];
```

```
Matrix A6 = MatrixForm[A6=Partition[Flatten[Thread[{Mtx6,Mty6}]],49]/N];
```

```
Matrix A7 = MatrixForm[A7=Partition[Flatten[Thread[{Mtx7,Mty7}]],49]/N];
```

Matrix A8 = MatrixForm[A8=Partition[Flatten[Thread[{Mtx8,Mty8}]],49]/N];

A = MatrixForm[A=Join[A1,A2,A3,A4,A5,A6,A7,A8]]/N];

L01=Flatten[Thread[{Lbx1,Lby1}]];L02=Flatten[Thread[{Lbx2,Lby2}]];

L03=Flatten[Thread[{Lbx3,Lby3}]];L04=Flatten[Thread[{Lbx4,Lby4}]];

L05=Flatten[Thread[{Lbx5,Lby5}]];L06=Flatten[Thread[{Lbx6,Lby6}]];

L07=Flatten[Thread[{Lbx7,Lby7}]];L08=Flatten[Thread[{Lbx8,Lby8}]];

MatrixForm[L0=Join[L01,L02,L03,L04,L05,L06,L07,L08]]];

Lb1=Flatten[Thread[{Phx1,Phy1}]];Lb2=Flatten[Thread[{Phx2,Phy2}]];

Lb3=Flatten[Thread[{Phx3,Phy3}]];Lb4=Flatten[Thread[{Phx4,Phy4}]];

Lb5=Flatten[Thread[{Phx5,Phy5}]];Lb6=Flatten[Thread[{Phx6,Phy6}]];

Lb7=Flatten[Thread[{Phx7,Phy7}]];Lb8=Flatten[Thread[{Phx8,Phy8}]];

MatrixForm[Lb=Join[Lb1,Lb2,Lb3,Lb4,Lb5,Lb6,Lb7,Lb8]]];

Matrix L = MatrixForm[L=L0-Lb];

Matrix Calculate

Nor=Transpose[A].P.A/N;U=Transpose[A].P.L/N;X=-PseudoInverse[Nor].U/N;

Xa=MatrixForm[Xa=Ex+X];

V=Partition[A.X+L,1];VtPV=Transpose[V].P.V;

st=Flatten[VtPV/((cp*2*8)-49)];Simaxy=st[[1]]*PseudoInverse[Nor];Tr[Simaxy,Varian];

Xa11=Xa[[{1,2,3}]];Xa12=Xa[[{4,5,6}]];Xap1=Join[Xa11 rad,Xa12 m];

Xa21=Xa[[{7,8,9}]];Xa22=Xa[[{10,11,12}]];Xap2=Join[Xa21 rad,Xa22 m];

Xa31=Xa[[{13,14,15}]];Xa32=Xa[[{16,17,18}]];Xap3=Join[Xa31 rad,Xa32 m];

Xa41=Xa[[{19,20,21}]];Xa42=Xa[[{22,23,24}]];Xap4=Join[Xa41 rad,Xa42 m];

Xa51=Xa[[{25,26,27}]];Xa52=Xa[[{28,29,30}]];Xap5=Join[Xa51 rad,Xa52 m];

Xa61=Xa[[{31,32,33}]];Xa62=Xa[[{34,35,36}]];Xap6=Join[Xa61 rad,Xa62 m];

Xa71=Xa[[{37,38,39}]];Xa72=Xa[[{40,41,42}]];Xap7=Join[Xa71 rad,Xa72 m];

Xa81=Xa[[{43,44,45}]];Xa82=Xa[[{46,47,48}]];Xap8=Join[Xa81 rad,Xa82 m];

Xai=Xa[[{49}]] m;

Output

Print["Photo1 = "MatrixForm[Xap1]," Photo2 = "MatrixForm[Xap2]]

Print["Photo3 = "MatrixForm[Xap3]," Photo4 = "MatrixForm[Xap4]]

Print["Photo5 = "MatrixForm[Xap5]," Photo6 = "MatrixForm[Xap6]]

Print["Photo7 = "MatrixForm[Xap7]," Photo8 = "MatrixForm[Xap8]]

Print["Internal = "MatrixForm[Xai]," VtPV = "[VtPV]]

Tr[Sqrt[Simaxy],Standard]

$$\begin{array}{l}
 \text{Photo1} = \begin{pmatrix} 0.0715897 \text{ rad} \\ 0.00183703 \text{ rad} \\ -0.00837985 \text{ rad} \\ 5.00784 \text{ m} \\ 4.97661 \text{ m} \\ 0.308735 \text{ m} \end{pmatrix} \quad \text{Photo2} = \begin{pmatrix} -0.0366266 \text{ rad} \\ 0.0196909 \text{ rad} \\ 1.54856 \text{ rad} \\ 4.99961 \text{ m} \\ 5.00272 \text{ m} \\ 0.308828 \text{ m} \end{pmatrix} \\
 \text{Photo3} = \begin{pmatrix} -0.0862363 \text{ rad} \\ -0.00744405 \text{ rad} \\ 3.11035 \text{ rad} \\ 4.98794 \text{ m} \\ 5.03915 \text{ m} \\ 0.318343 \text{ m} \end{pmatrix} \quad \text{Photo4} = \begin{pmatrix} -0.0121362 \text{ rad} \\ -0.0517748 \text{ rad} \\ 4.70867 \text{ rad} \\ 4.97933 \text{ m} \\ 4.9994 \text{ m} \\ 0.321824 \text{ m} \end{pmatrix} \\
 \text{Photo5} = \begin{pmatrix} -0.0214386 \text{ rad} \\ -0.0140502 \text{ rad} \\ 4.99365 \text{ m} \\ 4.80148 \text{ m} \\ 0.213065 \text{ m} \\ -0.764165 \text{ rad} \end{pmatrix} \quad \text{Photo6} = \begin{pmatrix} -0.0222005 \text{ rad} \\ 0.773808 \text{ rad} \\ 1.56841 \text{ rad} \\ 5.20382 \text{ m} \\ 5.00633 \text{ m} \\ 0.175596 \text{ m} \end{pmatrix} \\
 \text{Photo7} = \begin{pmatrix} -0.0392844 \text{ rad} \\ 3.12042 \text{ rad} \\ 4.98426 \text{ m} \\ 5.20919 \text{ m} \\ 0.198278 \text{ m} \end{pmatrix} \quad \text{Photo8} = \begin{pmatrix} 0.0121906 \text{ rad} \\ -0.782442 \text{ rad} \\ 4.72801 \text{ rad} \\ 4.8014 \text{ m} \\ 4.99164 \text{ m} \\ 0.16999 \text{ m} \end{pmatrix}
 \end{array}$$

$$\text{Internal} = (0.00621411 \text{ m}) \quad \text{VtPV} = \{ \{ \{ 4.38596 \times 10^{-10} \} \} \}$$

Standard[0.00979302,0.00989918,0.00144563,0.00326312,0.00312078,0.00232454,0.0100656,0.010063,0.00145808,0.0033144,0.00320405,0.00231248,0.00993676,0.0101529,0.00148312,0.00344818,0.00325598,0.00243269,0.0108387,0.0106758,0.00150632,0.00363974,0.00358384,0.00243604,0.00370844,0.00424113,0.00162269,0.00130292,0.00169456,0.0015884,0.00441546,0.00269021,0.00216334,0.00143033,0.000820791,0.00121848,0.00350314,0.00393616,0.00154537,0.00118939,0.00169275,0.00149516,0.00432856,0.00261706,0.00213046,0.00138482,0.000777333,0.00115133,0.0000457909]

ReApplications of Collinearity Eight Photo

INPUT Data From TextFile (*.txt)

Off[General::"spell1"]

Off[General::"spell"]

```
Dat=ReadList["C:\Thesis\SC50A 4\Mtmca4\D&C50A4f\S50A4f.txt",String,RecordLists & True];
```

```
cp=(Length[ReadList["C:\Thesis\SC50A4\Mtmca4\D&C50A4f\S50A4f.txt",String]]-17)/9;
```

(* Input Data File ????????.txt *)

```
Ed1=Delete[ReadList[StringToStream[Extract[Dat, {1,3}]],Number],1];
```

```
Ed2=Delete[ReadList[StringToStream[Extract[Dat, {1,4}]],Number],1];
```

```
Ed3=Delete[ReadList[StringToStream[Extract[Dat, {1,5}]],Number],1];
```

```
Ed4=Delete[ReadList[StringToStream[Extract[Dat, {1,6}]],Number],1];
```

```
Ed5=Delete[ReadList[StringToStream[Extract[Dat, {1,7}]],Number],1];
```

```
Ed6=Delete[ReadList[StringToStream[Extract[Dat, {1,8}]],Number],1];
```

```
Ed7=Delete[ReadList[StringToStream[Extract[Dat, {1,9}]],Number],1];
```

```
Ed8=Delete[ReadList[StringToStream[Extract[Dat, {1,10}]],Number],1];
```

```
Int=ReadList[StringToStream[Extract[Dat, {1,13}]],Number];
```

```
Ex=Join[Ed1,Ed2,Ed3,Ed4,Ed5,Ed6,Ed7,Ed8,Int];
```

```
Clear[Pc1,Pxy1,Pc2,Pxy2,Pc3,Pxy3,Pc4,Pxy4,Pc5,Pxy5,Pc6,Pxy6,Pc7,Pxy7,Pc8,Pxy8]
```

```
Pc1=Array[Pxy1,cp];Pc2=Array[Pxy2,cp];Pc3=Array[Pxy3,cp];Pc4=Array[Pxy4,cp];
```

```
Pc5=Array[Pxy5,cp];Pc6=Array[Pxy6,cp];Pc7=Array[Pxy7,cp];Pc8=Array[Pxy8,cp];
```

```
For[i=1,i<cp+1,Pxy1[i]=Delete[ReadList[StringToStream[Extract[Dat, {1,i+15}]],Number],1];i++]
```

```
For[i=1,i<cp+1,Pxy2[i]=Delete[ReadList[StringToStream[Extract[Dat, {1,i+15+cp}]],Number],1];i++]
```

```
For[i=1,i<cp+1,Pxy3[i]=Delete[ReadList[StringToStream[Extract[Dat, {1,i+15+cp*2}]],Number],1];i++]
```

```
For[i=1,i<cp+1,Pxy4[i]=Delete[ReadList[StringToStream[Extract[Dat, {1,i+15+cp*3}]],Number],1];i++]
```

```
For[i=1,i<cp+1,Pxy5[i]=Delete[ReadList[StringToStream[Extract[Dat, {1,i+15+cp*4}]],Number],1];i++]
```

```
For[i=1,i<cp+1,Pxy6[i]=Delete[ReadList[StringToStream[Extract[Dat, {1,i+15+cp*5}]],Number],1];i++]
```

```
For[i=1,i<cp+1,Pxy7[i]=Delete[ReadList[StringToStream[Extract[Dat, {1,i+15+cp*6}]],Number],1];i++]
```

```
For[i=1,i<cp+1,Pxy8[i]=Delete[ReadList[StringToStream[Extract[Dat, {1,i+15+cp*7}]],Number],1];i++]
```

```

Clear[Gc,Gxyz]
Gc=Array[Gxyz,cpt];
For[i=1,i<cp+1,Gxyz[i]=Delete[ReadList[StringToStream[Extract[Dat,{1,i+17+cp*8}]],Number],1];i++]

Print["Ext Parameter = "MatrixForm[Ex],"   VtPV = "[VtPV]]
Print["Photo (mm) = "MatrixForm[Pho=Join[Pc1,Pc2,Pc3,Pc4,Pc5,Pc6,Pc7,Pc8]],"   Ground
(m)"MatrixForm[Gc]]

Datt=ReadList["C:\Thesis\SC50A4\Mtmtca4\D&C50A4f\T50A4f.txt",String,RecordLists ->True];
cpt=(Length[ReadList["C:\Thesis\SC50A4\Mtmtca4\D&C50A4f\T50A4f.txt",String]]-4)/9;
(* Input Data File ????????.txt *)

Clear[Pct1,Pxyt1,Pct2,Pxyt2,Pct3,Pxyt3,Pct4,Pxyt4,Pct5,Pxyt5,Pct6,Pxyt6,Pct7,Pxyt7,Pct8,Pxyt8]
Pct1=Array[Pxyt1,cpt];Pct2=Array[Pxyt2,cpt];Pct3=Array[Pxyt3,cpt];Pct4=Array[Pxyt4,cpt];
Pct5=Array[Pxyt5,cpt];Pct6=Array[Pxyt6,cpt];Pct7=Array[Pxyt7,cpt];Pct8=Array[Pxyt8,cpt];

For[i=1,i<cpt+1,Pxyt1[i]=Delete[ReadList[StringToStream[Extract[Datt,{1,i+2}]],Number],1];i++]
For[i=1,i<cpt+1,Pxyt2[i]=Delete[ReadList[StringToStream[Extract[Datt,{1,i+2+cpt}]],Number],1];i++]
For[i=1,i<cpt+1,Pxyt3[i]=Delete[ReadList[StringToStream[Extract[Datt,{1,i+2+cpt*2}]],Number],1];i++]
For[i=1,i<cpt+1,Pxyt4[i]=Delete[ReadList[StringToStream[Extract[Datt,{1,i+2+cpt*3}]],Number],1];i++]
For[i=1,i<cpt+1,Pxyt5[i]=Delete[ReadList[StringToStream[Extract[Datt,{1,i+2+cpt*4}]],Number],1];i++]
For[i=1,i<cpt+1,Pxyt6[i]=Delete[ReadList[StringToStream[Extract[Datt,{1,i+2+cpt*5}]],Number],1];i++]
For[i=1,i<cpt+1,Pxyt7[i]=Delete[ReadList[StringToStream[Extract[Datt,{1,i+2+cpt*6}]],Number],1];i++]
For[i=1,i<cpt+1,Pxyt8[i]=Delete[ReadList[StringToStream[Extract[Datt,{1,i+2+cpt*7}]],Number],1];i++]

Clear[Gct,Gxyzt]
Gct=Array[Gxyzt,cpt];
For[i=1,i<cpt+1,Gxyzt[i]=Delete[ReadList[StringToStream[Extract[Datt,{1,i+4+cpt*8}]],Number],1];i++]

Print["Photo (m) = "MatrixForm[Pho=Join[Pct1,Pct2,Pct3,Pct4,Pct5,Pct6,Pct7,Pct8]],"   TiePoint
(m)"MatrixForm[Gct]]

```

```

aprox= Join[Ed1,Ed2,Ed3,Ed4,Ed5,Ed6,Ed7,Ed8,Flatten[Gct]];
(* Join[Ed1,Ed2,Ed3,Ed4,Ed5,Ed6,Ed7,Ed8,Flatten[Gct]] ; Iterate 2 = Xa *)

```

Create Variable In ARRAY

```
Clear[Ext12,Ep12]
```

```
Ext12=Array[Ep12,Length[aprox]];

```

```
Clear[Gxc,Gyc,Gzc,Gxi,Gyi,Gzi]
```

```
Gxc=Array[Gxi,(cp)];Gyc=Array[Gyi,(cp)];Gzc=Array[Gzi,(cp)];

```

```
Clear[Phx1,Phy1,Phx2,Phy2,Phx3,Phy3,Phx4,Phy4,Px1,Py1,Px2,Py2,Px3,Py3,Px4,Py4]
```

```
Clear[Phx5,Phy5,Phx6,Phy6,Phx7,Phy7,Phx8,Phy8,Px5,Py5,Px6,Py6,Px7,Py7,Px8,Py8]
```

```
Phx1=Array[Px1,cp];Phy1=Array[Py1,cp];Phx2=Array[Px2,cp];Phy2=Array[Py2,cp];

```

```
Phx3=Array[Px3,cp];Phy3=Array[Py3,cp];Phx4=Array[Px4,cp];Phy4=Array[Py4,cp];

```

```
Phx5=Array[Px5,cp];Phy5=Array[Py5,cp];Phx6=Array[Px6,cp];Phy6=Array[Py6,cp];

```

```
Phx7=Array[Px7,cp];Phy7=Array[Py7,cp];Phx8=Array[Px8,cp];Phy8=Array[Py8,cp];

```

```
Clear[Phxt1,Phyt1,Phxt2,Phyt2,Phxt3,Phyt3,Pxt1,Pyt1,Pxt2,Pyt2,Pxt3,Pyt3]
```

```
Clear[Phxt4,Phyt4,Phxt5,Phyt5,Phxt6,Phyt6,Pxt4,Pyt4,Pxt5,Pyt5,Pxt6,Pyt6]
```

```
Clear[Phxt7,Phyt7,Phxt8,Phyt8,Pxt7,Pyt7,Pxt8,Pyt8]
```

```
Phxt1=Array[Pxt1,cpt];Phyt1=Array[Pyt1,cpt];Phxt2=Array[Pxt2,cpt];Phyt2=Array[Pyt2,cpt];

```

```
Phxt3=Array[Pxt3,cpt];Phyt3=Array[Pyt3,cpt];Phxt4=Array[Pxt4,cpt];Phyt4=Array[Pyt4,cpt];

```

```
Phxt5=Array[Pxt5,cpt];Phyt5=Array[Pyt5,cpt];Phxt6=Array[Pxt6,cpt];Phyt6=Array[Pyt6,cpt];

```

```
Phxt7=Array[Pxt7,cpt];Phyt7=Array[Pyt7,cpt];Phxt8=Array[Pxt8,cpt];Phyt8=Array[Pyt8,cpt];

```

```
Clear[Mtx1,Mty1,Mtx2,Mty2,Mtx3,Mty3,Mtx4,Mty4,mx1,my1,mx2,my2,mx3,my3,mx4,my4]
```

```
Clear[Mtx5,Mty5,Mtx6,Mty6,Mtx7,Mty7,Mtx8,Mty8,mx5,my5,mx6,my6,mx7,my7,mx8,my8]
```

```
Mtx1=Array[mx1,cp];Mty1=Array[my1,cp];Mtx2=Array[mx2,cp];Mty2=Array[my2,cp];

```

```
Mtx3=Array[mx3,cp];Mty3=Array[my3,cp];Mtx4=Array[mx4,cp];Mty4=Array[my4,cp];

```

```
Mtx5=Array[mx5,cp];Mty5=Array[my5,cp];Mtx6=Array[mx6,cp];Mty6=Array[my6,cp];

```

```
Mtx7=Array[mx7,cp];Mty7=Array[my7,cp];Mtx8=Array[mx8,cp];Mty8=Array[my8,cp];

```

```

Clear[Mtxt1,Mtyt1,Mtxt2,Mtyt2,Mtxt3,Mtyt3,mxt1,myt1,mxt2,myt2,mxt3,myt3]
Clear[Mtxt4,Mtyt4,Mtxt5,Mtyt5,Mtxt6,Mtyt6,mxt4,myt4,mxt5,myt5,mxt6,myt6]
Clear[Mtxt7,Mtyt7,Mtxt8,Mtyt8,mxt7,myt7,mxt8,myt8]
Mtxt1=Array[mxt1,cpt];Mtyt1=Array[myt1,cpt];Mtxt2=Array[mxt2,cpt];Mtyt2=Array[myt2,cpt];
Mtxt3=Array[mxt3,cpt];Mtyt3=Array[myt3,cpt];Mtxt4=Array[mxt4,cpt];Mtyt4=Array[myt4,cpt];
Mtxt5=Array[mxt5,cpt];Mtyt5=Array[myt5,cpt];Mtxt6=Array[mxt6,cpt];Mtyt6=Array[myt6,cpt];
Mtxt7=Array[mxt7,cpt];Mtyt7=Array[myt7,cpt];Mtxt8=Array[mxt8,cpt];Mtyt8=Array[myt8,cpt];

```

```

Clear[Lbx1,Lby1,Lbx2,Lby2,Lbx3,Lby3,Lbx4,Lby4,Lx1,Ly1,Lx2,Ly2,Lx3,Ly3,Lx4,Ly4]
Clear[Lbx5,Lby5,Lbx6,Lby6,Lbx7,Lby7,Lbx8,Lby8,Lx5,Ly5,Lx6,Ly6,Lx7,Ly7,Lx8,Ly8]
Lbx1=Array[Lx1,cp];Lby1=Array[Ly1,cp];Lbx2=Array[Lx2,cp];Lby2=Array[Ly2,cp];
Lbx3=Array[Lx3,cp];Lby3=Array[Ly3,cp];Lbx4=Array[Lx4,cp];Lby4=Array[Ly4,cp];
Lbx5=Array[Lx5,cp];Lby5=Array[Ly5,cp];Lbx6=Array[Lx6,cp];Lby6=Array[Ly6,cp];
Lbx7=Array[Lx7,cp];Lby7=Array[Ly7,cp];Lbx8=Array[Lx8,cp];Lby8=Array[Ly8,cp];

```

```

Clear[Lbxt1,Lbyt1,Lbxt2,Lbyt2,Lbxt3,Lbyt3,Lxt1,Lyt1,Lxt2,Lyt2,Lxt3,Lyt3]
Clear[Lbxt4,Lbyt4,Lbxt5,Lbyt5,Lbxt6,Lbyt6,Lxt4,Lyt4,Lxt5,Lyt5,Lxt6,Lyt6]
Clear[Lbxt7,Lbyt7,Lbxt8,Lbyt8,Lxt7,Lyt7,Lxt8,Lyt8]
Lbxt1=Array[Lxt1,cpt];Lbyt1=Array[Lyt1,cpt];Lbxt2=Array[Lxt2,cpt];Lbyt2=Array[Lyt2,cpt];
Lbxt3=Array[Lxt3,cpt];Lbyt3=Array[Lyt3,cpt];Lbxt4=Array[Lxt4,cpt];Lbyt4=Array[Lyt4,cpt];
Lbxt5=Array[Lxt5,cpt];Lbyt5=Array[Lyt5,cpt];Lbxt6=Array[Lxt6,cpt];Lbyt6=Array[Lyt6,cpt];
Lbxt7=Array[Lxt7,cpt];Lbyt7=Array[Lyt7,cpt];Lbxt8=Array[Lxt8,cpt];Lbyt8=Array[Lyt8,cpt];

```

Rotation Matrix

```

so1=Sin[Ep12[1]];sf1=Sin[Ep12[2]];sk1=Sin[Ep12[3]];
co1=Cos[Ep12[1]];cf1=Cos[Ep12[2]];ck1=Cos[Ep12[3]];
r11a=cf1*ck1;r12a=so1*sf1*ck1+co1*sk1;r13a=-co1*sf1*ck1+so1*sk1;
r21a=-cf1*sk1;r22a=-so1*sf1*sk1+co1*ck1;r23a=co1*sf1*sk1+so1*ck1;
r31a=sf1;r32a=-so1*cf1;r33a=co1*cf1;
so2=Sin[Ep12[7]];sf2=Sin[Ep12[8]];sk2=Sin[Ep12[9]];
co2=Cos[Ep12[7]];cf2=Cos[Ep12[8]];ck2=Cos[Ep12[9]];
r11b=cf2*ck2;r12b=so2*sf2*ck2+co2*sk2;r13b=-co2*sf2*ck2+so2*sk2;

```

$r_{21b} = -cf_2 * sk_2; r_{22b} = -so_2 * sf_2 * sk_2 + co_2 * ck_2; r_{23b} = co_2 * sf_2 * sk_2 + so_2 * ck_2;$
 $r_{31b} = sf_2; r_{32b} = -so_2 * cf_2; r_{33b} = co_2 * cf_2;$
 $so_3 = \text{Sin}[\text{Ep12}[13]]; sf_3 = \text{Sin}[\text{Ep12}[14]]; sk_3 = \text{Sin}[\text{Ep12}[15]];$
 $co_3 = \text{Cos}[\text{Ep12}[13]]; cf_3 = \text{Cos}[\text{Ep12}[14]]; ck_3 = \text{Cos}[\text{Ep12}[15]];$
 $r_{11c} = cf_3 * ck_3; r_{12c} = so_3 * sf_3 * ck_3 + co_3 * sk_3; r_{13c} = -co_3 * sf_3 * ck_3 + so_3 * sk_3;$
 $r_{21c} = -cf_3 * sk_3; r_{22c} = -so_3 * sf_3 * sk_3 + co_3 * ck_3; r_{23c} = co_3 * sf_3 * sk_3 + so_3 * ck_3;$
 $r_{31c} = sf_3; r_{32c} = -so_3 * cf_3; r_{33c} = co_3 * cf_3;$
 $so_4 = \text{Sin}[\text{Ep12}[19]]; sf_4 = \text{Sin}[\text{Ep12}[20]]; sk_4 = \text{Sin}[\text{Ep12}[21]];$
 $co_4 = \text{Cos}[\text{Ep12}[19]]; cf_4 = \text{Cos}[\text{Ep12}[20]]; ck_4 = \text{Cos}[\text{Ep12}[21]];$
 $r_{11d} = cf_4 * ck_4; r_{12d} = so_4 * sf_4 * ck_4 + co_4 * sk_4; r_{13d} = -co_4 * sf_4 * ck_4 + so_4 * sk_4;$
 $r_{21d} = -cf_4 * sk_4; r_{22d} = -so_4 * sf_4 * sk_4 + co_4 * ck_4; r_{23d} = co_4 * sf_4 * sk_4 + so_4 * ck_4;$
 $r_{31d} = sf_4; r_{32d} = -so_4 * cf_4; r_{33d} = co_4 * cf_4;$
 $so_5 = \text{Sin}[\text{Ep12}[25]]; sf_5 = \text{Sin}[\text{Ep12}[26]]; sk_5 = \text{Sin}[\text{Ep12}[27]];$
 $co_5 = \text{Cos}[\text{Ep12}[25]]; cf_5 = \text{Cos}[\text{Ep12}[26]]; ck_5 = \text{Cos}[\text{Ep12}[27]];$
 $r_{11e} = cf_5 * ck_5; r_{12e} = so_5 * sf_5 * ck_5 + co_5 * sk_5; r_{13e} = -co_5 * sf_5 * ck_5 + so_5 * sk_5;$
 $r_{21e} = -cf_5 * sk_5; r_{22e} = -so_5 * sf_5 * sk_5 + co_5 * ck_5; r_{23e} = co_5 * sf_5 * sk_5 + so_5 * ck_5;$
 $r_{31e} = sf_5; r_{32e} = -so_5 * cf_5; r_{33e} = co_5 * cf_5;$
 $so_6 = \text{Sin}[\text{Ep12}[31]]; sf_6 = \text{Sin}[\text{Ep12}[32]]; sk_6 = \text{Sin}[\text{Ep12}[33]];$
 $co_6 = \text{Cos}[\text{Ep12}[31]]; cf_6 = \text{Cos}[\text{Ep12}[32]]; ck_6 = \text{Cos}[\text{Ep12}[33]];$
 $r_{11f} = cf_6 * ck_6; r_{12f} = so_6 * sf_6 * ck_6 + co_6 * sk_6; r_{13f} = -co_6 * sf_6 * ck_6 + so_6 * sk_6;$
 $r_{21f} = -cf_6 * sk_6; r_{22f} = -so_6 * sf_6 * sk_6 + co_6 * ck_6; r_{23f} = co_6 * sf_6 * sk_6 + so_6 * ck_6;$
 $r_{31f} = sf_6; r_{32f} = -so_6 * cf_6; r_{33f} = co_6 * cf_6;$
 $so_7 = \text{Sin}[\text{Ep12}[37]]; sf_7 = \text{Sin}[\text{Ep12}[38]]; sk_7 = \text{Sin}[\text{Ep12}[39]];$
 $co_7 = \text{Cos}[\text{Ep12}[37]]; cf_7 = \text{Cos}[\text{Ep12}[38]]; ck_7 = \text{Cos}[\text{Ep12}[39]];$
 $r_{11g} = cf_7 * ck_7; r_{12g} = so_7 * sf_7 * ck_7 + co_7 * sk_7; r_{13g} = -co_7 * sf_7 * ck_7 + so_7 * sk_7;$
 $r_{21g} = -cf_7 * sk_7; r_{22g} = -so_7 * sf_7 * sk_7 + co_7 * ck_7; r_{23g} = co_7 * sf_7 * sk_7 + so_7 * ck_7;$
 $r_{31g} = sf_7; r_{32g} = -so_7 * cf_7; r_{33g} = co_7 * cf_7;$
 $so_8 = \text{Sin}[\text{Ep12}[43]]; sf_8 = \text{Sin}[\text{Ep12}[44]]; sk_8 = \text{Sin}[\text{Ep12}[45]];$
 $co_8 = \text{Cos}[\text{Ep12}[43]]; cf_8 = \text{Cos}[\text{Ep12}[44]]; ck_8 = \text{Cos}[\text{Ep12}[45]];$
 $r_{11h} = cf_8 * ck_8; r_{12h} = so_8 * sf_8 * ck_8 + co_8 * sk_8; r_{13h} = -co_8 * sf_8 * ck_8 + so_8 * sk_8;$
 $r_{21h} = -cf_8 * sk_8; r_{22h} = -so_8 * sf_8 * sk_8 + co_8 * ck_8; r_{23h} = co_8 * sf_8 * sk_8 + so_8 * ck_8;$
 $r_{31h} = sf_8; r_{32h} = -so_8 * cf_8; r_{33h} = co_8 * cf_8;$

Colinearity Condition Equation

$$F_{x1}[\{X_{i1}, X_{o1}, Y_{i1}, Y_{o1}, Z_{i1}, Z_{o1}\}] = (-\text{Int}[[1]] * ((r_{11a} * (X_{i1} - X_{o1}) + r_{12a} * (Y_{i1} - Y_{o1}) + r_{13a} * (Z_{i1} - Z_{o1})) / (r_{31a} * (X_{i1} - X_{o1}) + r_{32a} * (Y_{i1} - Y_{o1}) + r_{33a} * (Z_{i1} - Z_{o1}))))$$

$$F_{y1}[\{X_{i1}, X_{o1}, Y_{i1}, Y_{o1}, Z_{i1}, Z_{o1}\}] = (-\text{Int}[[1]] * ((r_{21a} * (X_{i1} - X_{o1}) + r_{22a} * (Y_{i1} - Y_{o1}) + r_{23a} * (Z_{i1} - Z_{o1})) / (r_{31a} * (X_{i1} - X_{o1}) + r_{32a} * (Y_{i1} - Y_{o1}) + r_{33a} * (Z_{i1} - Z_{o1}))))$$

$$F_{x2}[\{X_{i2}, X_{o2}, Y_{i2}, Y_{o2}, Z_{i2}, Z_{o2}\}] = (-\text{Int}[[1]] * ((r_{11b} * (X_{i2} - X_{o2}) + r_{12b} * (Y_{i2} - Y_{o2}) + r_{13b} * (Z_{i2} - Z_{o2})) / (r_{31b} * (X_{i2} - X_{o2}) + r_{32b} * (Y_{i2} - Y_{o2}) + r_{33b} * (Z_{i2} - Z_{o2}))))$$

$$F_{y2}[\{X_{i2}, X_{o2}, Y_{i2}, Y_{o2}, Z_{i2}, Z_{o2}\}] = (-\text{Int}[[1]] * ((r_{21b} * (X_{i2} - X_{o2}) + r_{22b} * (Y_{i2} - Y_{o2}) + r_{23b} * (Z_{i2} - Z_{o2})) / (r_{31b} * (X_{i2} - X_{o2}) + r_{32b} * (Y_{i2} - Y_{o2}) + r_{33b} * (Z_{i2} - Z_{o2}))))$$

$$F_{x3}[\{X_{i3}, X_{o3}, Y_{i3}, Y_{o3}, Z_{i3}, Z_{o3}\}] = (-\text{Int}[[1]] * ((r_{11c} * (X_{i3} - X_{o3}) + r_{12c} * (Y_{i3} - Y_{o3}) + r_{13c} * (Z_{i3} - Z_{o3})) / (r_{31c} * (X_{i3} - X_{o3}) + r_{32c} * (Y_{i3} - Y_{o3}) + r_{33c} * (Z_{i3} - Z_{o3}))))$$

$$F_{y3}[\{X_{i3}, X_{o3}, Y_{i3}, Y_{o3}, Z_{i3}, Z_{o3}\}] = (-\text{Int}[[1]] * ((r_{21c} * (X_{i3} - X_{o3}) + r_{22c} * (Y_{i3} - Y_{o3}) + r_{23c} * (Z_{i3} - Z_{o3})) / (r_{31c} * (X_{i3} - X_{o3}) + r_{32c} * (Y_{i3} - Y_{o3}) + r_{33c} * (Z_{i3} - Z_{o3}))))$$

$$F_{x4}[\{X_{i4}, X_{o4}, Y_{i4}, Y_{o4}, Z_{i4}, Z_{o4}\}] = (-\text{Int}[[1]] * ((r_{11d} * (X_{i4} - X_{o4}) + r_{12d} * (Y_{i4} - Y_{o4}) + r_{13d} * (Z_{i4} - Z_{o4})) / (r_{31d} * (X_{i4} - X_{o4}) + r_{32d} * (Y_{i4} - Y_{o4}) + r_{33d} * (Z_{i4} - Z_{o4}))))$$

$$F_{y4}[\{X_{i4}, X_{o4}, Y_{i4}, Y_{o4}, Z_{i4}, Z_{o4}\}] = (-\text{Int}[[1]] * ((r_{21d} * (X_{i4} - X_{o4}) + r_{22d} * (Y_{i4} - Y_{o4}) + r_{23d} * (Z_{i4} - Z_{o4})) / (r_{31d} * (X_{i4} - X_{o4}) + r_{32d} * (Y_{i4} - Y_{o4}) + r_{33d} * (Z_{i4} - Z_{o4}))))$$

$$F_{x5}[\{X_{i5}, X_{o5}, Y_{i5}, Y_{o5}, Z_{i5}, Z_{o5}\}] = (-\text{Int}[[1]] * ((r_{11e} * (X_{i5} - X_{o5}) + r_{12e} * (Y_{i5} - Y_{o5}) + r_{13e} * (Z_{i5} - Z_{o5})) / (r_{31e} * (X_{i5} - X_{o5}) + r_{32e} * (Y_{i5} - Y_{o5}) + r_{33e} * (Z_{i5} - Z_{o5}))))$$

$$F_{y5}[\{X_{i5}, X_{o5}, Y_{i5}, Y_{o5}, Z_{i5}, Z_{o5}\}] = (-\text{Int}[[1]] * ((r_{21e} * (X_{i5} - X_{o5}) + r_{22e} * (Y_{i5} - Y_{o5}) + r_{23e} * (Z_{i5} - Z_{o5})) / (r_{31e} * (X_{i5} - X_{o5}) + r_{32e} * (Y_{i5} - Y_{o5}) + r_{33e} * (Z_{i5} - Z_{o5}))))$$

$$F_{x6}[\{X_{i6}, X_{o6}, Y_{i6}, Y_{o6}, Z_{i6}, Z_{o6}\}] = (-\text{Int}[[1]] * ((r_{11f} * (X_{i6} - X_{o6}) + r_{12f} * (Y_{i6} - Y_{o6}) + r_{13f} * (Z_{i6} - Z_{o6})) / (r_{31f} * (X_{i6} - X_{o6}) + r_{32f} * (Y_{i6} - Y_{o6}) + r_{33f} * (Z_{i6} - Z_{o6}))))$$

$$F_{y6}[\{X_{i6}, X_{o6}, Y_{i6}, Y_{o6}, Z_{i6}, Z_{o6}\}] = (-\text{Int}[[1]] * ((r_{21f} * (X_{i6} - X_{o6}) + r_{22f} * (Y_{i6} - Y_{o6}) + r_{23f} * (Z_{i6} - Z_{o6})) / (r_{31f} * (X_{i6} - X_{o6}) + r_{32f} * (Y_{i6} - Y_{o6}) + r_{33f} * (Z_{i6} - Z_{o6}))))$$

$$F_{x7}[\{X_{i7}, X_{o7}, Y_{i7}, Y_{o7}, Z_{i7}, Z_{o7}\}] = (-\text{Int}[[1]] * ((r_{11g} * (X_{i7} - X_{o7}) + r_{12g} * (Y_{i7} - Y_{o7}) + r_{13g} * (Z_{i7} - Z_{o7})) / (r_{31g} * (X_{i7} - X_{o7}) + r_{32g} * (Y_{i7} - Y_{o7}) + r_{33g} * (Z_{i7} - Z_{o7}))))$$

$$F_{y7}[\{X_{i7}, X_{o7}, Y_{i7}, Y_{o7}, Z_{i7}, Z_{o7}\}] = (-\text{Int}[[1]] * ((r_{21g} * (X_{i7} - X_{o7}) + r_{22g} * (Y_{i7} - Y_{o7}) + r_{23g} * (Z_{i7} - Z_{o7})) / (r_{31g} * (X_{i7} - X_{o7}) + r_{32g} * (Y_{i7} - Y_{o7}) + r_{33g} * (Z_{i7} - Z_{o7}))))$$

$$F_{x8}[\{X_{i8}, X_{o8}, Y_{i8}, Y_{o8}, Z_{i8}, Z_{o8}\}] = (-\text{Int}[[1]] * ((r_{11h} * (X_{i8} - X_{o8}) + r_{12h} * (Y_{i8} - Y_{o8}) + r_{13h} * (Z_{i8} - Z_{o8})) / (r_{31h} * (X_{i8} - X_{o8}) + r_{32h} * (Y_{i8} - Y_{o8}) + r_{33h} * (Z_{i8} - Z_{o8}))))$$

$$Fy8\{\{Xi8_Xo8_Yi8_Yo8_Zi8_Zo8_}\}:=(-Int[1])*((r21h*(Xi8-Xo8)+r22h*(Yi8-Yo8)+r23h*(Zi8-Zo8))/(r31h*(Xi8-Xo8)+r32h*(Yi8-Yo8)+r33h*(Zi8-Zo8)))$$

Matrix A and Matrix L

```

For[i=1,i<cp+1,mx1[i]=Map[D[Fx1[{Gxc[[i]],Ep12[4],Gyc[[i]],Ep12[5],Gzc[[i]],Ep12[6]}],#]&,Ext12];
  my1[i]=Map[D[Fy1[{Gxc[[i]],Ep12[4],Gyc[[i]],Ep12[5],Gzc[[i]],Ep12[6]}],#]&,Ext12];i++]
For[i=1,i<cp+1,mx2[i]=Map[D[Fx2[{Gxc[[i]],Ep12[10],Gyc[[i]],Ep12[11],Gzc[[i]],Ep12[12]}],#]&,
Ext12];my2[i]=Map[D[Fy2[{Gxc[[i]],Ep12[10],Gyc[[i]],Ep12[11],Gzc[[i]],Ep12[12]}],#]&,Ext12];i++]
For[i=1,i<cp+1,mx3[i]=Map[D[Fx3[{Gxc[[i]],Ep12[16],Gyc[[i]],Ep12[17],Gzc[[i]],Ep12[18]}],#]&,
Ext12];my3[i]=Map[D[Fy3[{Gxc[[i]],Ep12[16],Gyc[[i]],Ep12[17],Gzc[[i]],Ep12[18]}],#]&,Ext12];i++]
For[i=1,i<cp+1,mx4[i]=Map[D[Fx4[{Gxc[[i]],Ep12[22],Gyc[[i]],Ep12[23],Gzc[[i]],Ep12[24]}],#]&,
Ext12];my4[i]=Map[D[Fy4[{Gxc[[i]],Ep12[22],Gyc[[i]],Ep12[23],Gzc[[i]],Ep12[24]}],#]&,Ext12];i++]
For[i=1,i<cp+1,mx5[i]=Map[D[Fx5[{Gxc[[i]],Ep12[28],Gyc[[i]],Ep12[29],Gzc[[i]],Ep12[30]}],#]&,
Ext12];my5[i]=Map[D[Fy5[{Gxc[[i]],Ep12[28],Gyc[[i]],Ep12[29],Gzc[[i]],Ep12[30]}],#]&,Ext12];i++]
For[i=1,i<cp+1,mx6[i]=Map[D[Fx6[{Gxc[[i]],Ep12[34],Gyc[[i]],Ep12[35],Gzc[[i]],Ep12[36]}],#]&,
Ext12];my6[i]=Map[D[Fy6[{Gxc[[i]],Ep12[34],Gyc[[i]],Ep12[35],Gzc[[i]],Ep12[36]}],#]&,Ext12];i++]
For[i=1,i<cp+1,mx7[i]=Map[D[Fx7[{Gxc[[i]],Ep12[40],Gyc[[i]],Ep12[41],Gzc[[i]],Ep12[42]}],#]&,
Ext12];my7[i]=Map[D[Fy7[{Gxc[[i]],Ep12[40],Gyc[[i]],Ep12[41],Gzc[[i]],Ep12[42]}],#]&,Ext12];i++]
For[i=1,i<cp+1,mx8[i]=Map[D[Fx8[{Gxc[[i]],Ep12[46],Gyc[[i]],Ep12[47],Gzc[[i]],Ep12[48]}],#]&,
Ext12];my8[i]=Map[D[Fy8[{Gxc[[i]],Ep12[46],Gyc[[i]],Ep12[47],Gzc[[i]],Ep12[48]}],#]&,Ext12];i++]

For[i=0,i<cpt,ci=i*3;ii=1;ii=ii+i;mxt1[ii]=Map[D[Fx1[{Ep12[ci+49],Ep12[4],Ep12[ci+50],Ep12[5],Ep12
[ci+51],Ep12[6]}],#]&,Ext12];myt1[ii]=Map[D[Fy1[{Ep12[ci+49],Ep12[4],Ep12[ci+50],Ep12[5],Ep12
[ci+51],Ep12[6]}],#]&,Ext12];i++]
For[i=0,i<cpt,ci=i*3;ii=1;ii=ii+i;mxt2[ii]=Map[D[Fx2[{Ep12[ci+49],Ep12[10],Ep12[ci+50],Ep12
[11],Ep12[ci+51],Ep12[12]}],#]&,Ext12];myt2[ii]=Map[D[Fy2[{Ep12[ci+49],Ep12[10],Ep12
[ci+50],Ep12[11],Ep12[ci+51],Ep12[12]}],#]&,Ext12];i++]
For[i=0,i<cpt,ci=i*3;ii=1;ii=ii+i;mxt3[ii]=Map[D[Fx3[{Ep12[ci+49],Ep12[16],Ep12[ci+50],Ep12
[17],Ep12[ci+51],Ep12[18]}],#]&,Ext12];myt3[ii]=Map[D[Fy3[{Ep12[ci+49],Ep12[16],Ep12
[ci+50],Ep12[17],Ep12[ci+51],Ep12[18]}],#]&,Ext12];i++]

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For[i=0,i<cpt,ci=i*3;ii=1;ii=ii+i;mxt4[ii]=Map[D[Fx4[{Ep12[ci+49],Ep12[22],Ep12[ci+50],Ep12
[23],Ep12[ci+51],Ep12[24]}],#]&,Ext12];myt4[ii]=Map[D[Fy4[{Ep12[ci+49],Ep12[22],Ep12
[ci+50],Ep12[23],Ep12[ci+51],Ep12[24]}],#]&,Ext12];i++]
For[i=0,i<cpt,ci=i*3;ii=1;ii=ii+i;mxt5[ii]=Map[D[Fx5[{Ep12[ci+49],Ep12[28],Ep12[ci+50],Ep12
[29],Ep12[ci+51],Ep12[30]}],#]&,Ext12];myt5[ii]=Map[D[Fy5[{Ep12[ci+49],Ep12[28],Ep12
[ci+50],Ep12[29],Ep12[ci+51],Ep12[30]}],#]&,Ext12];i++]
For[i=0,i<cpt,ci=i*3;ii=1;ii=ii+i;mxt6[ii]=Map[D[Fx6[{Ep12[ci+49],Ep12[34],Ep12[ci+50],Ep12
[35],Ep12[ci+51],Ep12[36]}],#]&,Ext12];myt6[ii]=Map[D[Fy6[{Ep12[ci+49],Ep12[34],Ep12
[ci+50],Ep12[35],Ep12[ci+51],Ep12[36]}],#]&,Ext12];i++]
For[i=0,i<cpt,ci=i*3;ii=1;ii=ii+i;mxt7[ii]=Map[D[Fx7[{Ep12[ci+49],Ep12[40],Ep12[ci+50],Ep12
[41],Ep12[ci+51],Ep12[42]}],#]&,Ext12];myt7[ii]=Map[D[Fy7[{Ep12[ci+49],Ep12[40],Ep12
[ci+50],Ep12[41],Ep12[ci+51],Ep12[42]}],#]&,Ext12];i++]
For[i=0,i<cpt,ci=i*3;ii=1;ii=ii+i;mxt8[ii]=Map[D[Fx8[{Ep12[ci+49],Ep12[46],Ep12[ci+50],Ep12
[47],Ep12[ci+51],Ep12[48]}],#]&,Ext12];myt8[ii]=Map[D[Fy8[{Ep12[ci+49],Ep12[46],Ep12
[ci+50],Ep12[47],Ep12[ci+51],Ep12[48]}],#]&,Ext12];i++]
For[i=1,i<cp+1,Lx1[i]=Fx1[{Gxc[[i],Ep12[4],Gyc[[i],Ep12[5],Gzc[[i],Ep12[6]}];Ly1[i]=Fy1[{Gxc
[[i],Ep12[4],Gyc[[i],Ep12[5],Gzc[[i],Ep12[6]}];i++]
For[i=1,i<cp+1,Lx2[i]=Fx2[{Gxc[[i],Ep12[10],Gyc[[i],Ep12[11],Gzc[[i],Ep12[12]}];Ly2[i]=Fy2[{Gxc
[[i],Ep12[10],Gyc[[i],Ep12[11],Gzc[[i],Ep12[12]}];i++]
For[i=1,i<cp+1,Lx3[i]=Fx3[{Gxc[[i],Ep12[16],Gyc[[i],Ep12[17],Gzc[[i],Ep12[18]}];Ly3[i]=Fy3[{Gxc
[[i],Ep12[16],Gyc[[i],Ep12[17],Gzc[[i],Ep12[18]}];i++]
For[i=1,i<cp+1,Lx4[i]=Fx4[{Gxc[[i],Ep12[22],Gyc[[i],Ep12[23],Gzc[[i],Ep12[24]}];Ly4[i]=Fy4[{Gxc
[[i],Ep12[22],Gyc[[i],Ep12[23],Gzc[[i],Ep12[24]}];i++]
For[i=1,i<cp+1,Lx5[i]=Fx5[{Gxc[[i],Ep12[28],Gyc[[i],Ep12[29],Gzc[[i],Ep12[30]}];Ly5[i]=Fy5[{Gxc
[[i],Ep12[28],Gyc[[i],Ep12[29],Gzc[[i],Ep12[30]}];i++]
For[i=1,i<cp+1,Lx6[i]=Fx6[{Gxc[[i],Ep12[34],Gyc[[i],Ep12[35],Gzc[[i],Ep12[36]}];Ly6[i]=Fy6[{Gxc
[[i],Ep12[34],Gyc[[i],Ep12[35],Gzc[[i],Ep12[36]}];i++]
For[i=1,i<cp+1,Lx7[i]=Fx7[{Gxc[[i],Ep12[40],Gyc[[i],Ep12[41],Gzc[[i],Ep12[42]}];Ly7[i]=Fy7[{Gxc
[[i],Ep12[40],Gyc[[i],Ep12[41],Gzc[[i],Ep12[42]}];i++]
For[i=1,i<cp+1,Lx8[i]=Fx8[{Gxc[[i],Ep12[46],Gyc[[i],Ep12[47],Gzc[[i],Ep12[48]}];Ly8[i]=Fy8[{Gxc
[[i],Ep12[46],Gyc[[i],Ep12[47],Gzc[[i],Ep12[48]}];i++]

```

```

For[i=0,i<cpt,ci=i*3;ii=1;ii=ii+i;Lxt1[ii]=Fx1[{Ep12[ci+49],Ep12[4],Ep12[ci+50],Ep12[5],Ep12
[ci+51],Ep12[6]}];Lyt1[ii]=Fy1[{Ep12[ci+49],Ep12[4],Ep12[ci+50],Ep12[5],Ep12[ci+51],Ep12[6]}];i++]
For[i=0,i<cpt,ci=i*3;ii=1;ii=ii+i;Lxt2[ii]=Fx2[{Ep12[ci+49],Ep12[10],Ep12[ci+50],Ep12[11],Ep12[ci+51
],Ep12[12]}];Lyt2[ii]=Fy2[{Ep12[ci+49],Ep12[10],Ep12[ci+50],Ep12[11],Ep12[ci+51],Ep12[12]}];i++]
For[i=0,i<cpt,ci=i*3;ii=1;ii=ii+i;Lxt3[ii]=Fx3[{Ep12[ci+49],Ep12[16],Ep12[ci+50],Ep12[17],Ep12[ci+51
],Ep12[18]}];Lyt3[ii]=Fy3[{Ep12[ci+49],Ep12[16],Ep12[ci+50],Ep12[17],Ep12[ci+51],Ep12[18]}];i++]
For[i=0,i<cpt,ci=i*3;ii=1;ii=ii+i;Lxt4[ii]=Fx4[{Ep12[ci+49],Ep12[22],Ep12[ci+50],Ep12[23],Ep12[ci+51
],Ep12[24]}];Lyt4[ii]=Fy4[{Ep12[ci+49],Ep12[22],Ep12[ci+50],Ep12[23],Ep12[ci+51],Ep12[24]}];i++]
For[i=0,i<cpt,ci=i*3;ii=1;ii=ii+i;Lxt5[ii]=Fx5[{Ep12[ci+49],Ep12[28],Ep12[ci+50],Ep12[29],Ep12[ci+51
],Ep12[30]}];Lyt5[ii]=Fy5[{Ep12[ci+49],Ep12[28],Ep12[ci+50],Ep12[29],Ep12[ci+51],Ep12[30]}];i++]
For[i=0,i<cpt,ci=i*3;ii=1;ii=ii+i;Lxt6[ii]=Fx6[{Ep12[ci+49],Ep12[34],Ep12[ci+50],Ep12[35],Ep12[ci+51
],Ep12[36]}];Lyt6[ii]=Fy6[{Ep12[ci+49],Ep12[34],Ep12[ci+50],Ep12[35],Ep12[ci+51],Ep12[36]}];i++]
For[i=0,i<cpt,ci=i*3;ii=1;ii=ii+i;Lxt7[ii]=Fx7[{Ep12[ci+49],Ep12[40],Ep12[ci+50],Ep12[41],Ep12[ci+51
],Ep12[42]}];Lyt7[ii]=Fy7[{Ep12[ci+49],Ep12[40],Ep12[ci+50],Ep12[41],Ep12[ci+51],Ep12[42]}];i++]
For[i=0,i<cpt,ci=i*3;ii=1;ii=ii+i;Lxt8[ii]=Fx8[{Ep12[ci+49],Ep12[46],Ep12[ci+50],Ep12[47],Ep12[ci+51
],Ep12[48]}];Lyt8[ii]=Fy8[{Ep12[ci+49],Ep12[46],Ep12[ci+50],Ep12[47],Ep12[ci+51],Ep12[48]}];i++]

```

Weight Matrix

Q = 1;

Rfv=2.92E-11;

P=Rfv*Inverse[IdentityMatrix[cp*2*8+cpt*2*8]*Q];

In Place Of Matrix

```

For[i=1,i<Length[aprox]+1,Ep12[i]=aprox[[i]];i++]

```

```

For[i=1,i<cp+1,Gxi[i]=Gxyz[i][[1]];Gyi[i]=Gxyz[i][[2]];Gzi[i]=Gxyz[i][[3]];i++]

```

```

For[i=1,i<cp+1,Px1[i]=Pxy1[i][[1]];Py1[i]=Pxy1[i][[2]];i++]

```

```

For[i=1,i<cp+1,Px2[i]=Pxy2[i][[1]];Py2[i]=Pxy2[i][[2]];i++]

```

```

For[i=1,i<cp+1,Px3[i]=Pxy3[i][[1]];Py3[i]=Pxy3[i][[2]];i++]

```

```

For[i=1,i<cp+1,Px4[i]=Pxy4[i][[1]];Py4[i]=Pxy4[i][[2]];i++]

```

```

For[i=1,i<cp+1,Px5[i]=Pxy5[i][[1]];Py5[i]=Pxy5[i][[2]];i++]

```

```

For[i=1,i<cp+1,Px6[i]=Pxy6[i][[1]];Py6[i]=Pxy6[i][[2]];i++]

```

```

For[i=1,i<cp+1,Px7[i]=Pxy7[i][[1]];Py7[i]=Pxy7[i][[2]];i++]
For[i=1,i<cp+1,Px8[i]=Pxy8[i][[1]];Py8[i]=Pxy8[i][[2]];i++]
For[i=1,i<cpt+1,Pxt1[i]=Pxyt1[i][[1]];Pyt1[i]=Pxyt1[i][[2]];i++]
For[i=1,i<cpt+1,Pxt2[i]=Pxyt2[i][[1]];Pyt2[i]=Pxyt2[i][[2]];i++]
For[i=1,i<cpt+1,Pxt3[i]=Pxyt3[i][[1]];Pyt3[i]=Pxyt3[i][[2]];i++]
For[i=1,i<cpt+1,Pxt4[i]=Pxyt4[i][[1]];Pyt4[i]=Pxyt4[i][[2]];i++]
For[i=1,i<cpt+1,Pxt5[i]=Pxyt5[i][[1]];Pyt5[i]=Pxyt5[i][[2]];i++]
For[i=1,i<cpt+1,Pxt6[i]=Pxyt6[i][[1]];Pyt6[i]=Pxyt6[i][[2]];i++]
For[i=1,i<cpt+1,Pxt7[i]=Pxyt7[i][[1]];Pyt7[i]=Pxyt7[i][[2]];i++]
For[i=1,i<cpt+1,Pxt8[i]=Pxyt8[i][[1]];Pyt8[i]=Pxyt8[i][[2]];i++]

"Matrix A1 = "MatrixForm[A1=Partition[Flatten[Thread[ {Mtx1,Mty1} ]],(6*8+cpt*3)]/N];
"Matrix A1t = "MatrixForm[A1t=Partition[Flatten[Thread[ {Mtxt1,Mtyt1} ]],(6*8+cpt*3)]/N];
"At1 = "MatrixForm[At1=Join[A1,A1t]]/N];
"Matrix A2 = "MatrixForm[A2=Partition[Flatten[Thread[ {Mtx2,Mty2} ]],(6*8+cpt*3)]/N];
"Matrix A2t = "MatrixForm[A2t=Partition[Flatten[Thread[ {Mtxt2,Mtyt2} ]],(6*8+cpt*3)]/N];
"At2 = "MatrixForm[At2=Join[A2,A2t]]/N];
"Matrix A3 = "MatrixForm[A3=Partition[Flatten[Thread[ {Mtx3,Mty3} ]],(6*8+cpt*3)]/N];
"Matrix A3t = "MatrixForm[A3t=Partition[Flatten[Thread[ {Mtxt3,Mtyt3} ]],(6*8+cpt*3)]/N];
"At3 = "MatrixForm[At3=Join[A3,A3t]]/N];
"Matrix A4 = "MatrixForm[A4=Partition[Flatten[Thread[ {Mtx4,Mty4} ]],(6*8+cpt*3)]/N];
"Matrix A4t = "MatrixForm[A4t=Partition[Flatten[Thread[ {Mtxt4,Mtyt4} ]],(6*8+cpt*3)]/N];
"At4 = "MatrixForm[At4=Join[A4,A4t]]/N];
"Matrix A5 = "MatrixForm[A5=Partition[Flatten[Thread[ {Mtx5,Mty5} ]],(6*8+cpt*3)]/N];
"Matrix A5t = "MatrixForm[A5t=Partition[Flatten[Thread[ {Mtxt5,Mtyt5} ]],(6*8+cpt*3)]/N];
"At5 = "MatrixForm[At5=Join[A5,A5t]]/N];
"Matrix A6 = "MatrixForm[A6=Partition[Flatten[Thread[ {Mtx6,Mty6} ]],(6*8+cpt*3)]/N];
"Matrix A6t = "MatrixForm[A6t=Partition[Flatten[Thread[ {Mtxt6,Mtyt6} ]],(6*8+cpt*3)]/N];
"At6 = "MatrixForm[At6=Join[A6,A6t]]/N];
"Matrix A7 = "MatrixForm[A7=Partition[Flatten[Thread[ {Mtx7,Mty7} ]],(6*8+cpt*3)]/N];
"Matrix A7t = "MatrixForm[A7t=Partition[Flatten[Thread[ {Mtxt7,Mtyt7} ]],(6*8+cpt*3)]/N];
"At7 = "MatrixForm[At7=Join[A7,A7t]]/N];

```

"Matrix A8 = "MatrixForm[A8=Partition[Flatten[Thread[{Mtx8,Mty8}]],(6*8+cpt*3)]//N];

"Matrix A8t = "MatrixForm[A8t=Partition[Flatten[Thread[{Mtxt8,Mtyt8}]],(6*8+cpt*3)]//N];

"At8 = "MatrixForm[At8=Join[A8,A8t]]//N];

"A = "MatrixForm[A=Join[At1,At2,At3,At4,At5,At6,At7,At8]]//N];

L01=Flatten[Thread[{Lbx1,Lby1}]];L0t1=Flatten[Thread[{Lbxt1,Lbyt1}]];Lt1=Join[L01,L0t1];

L02=Flatten[Thread[{Lbx2,Lby2}]];L0t2=Flatten[Thread[{Lbxt2,Lbyt2}]];Lt2=Join[L02,L0t2];

L03=Flatten[Thread[{Lbx3,Lby3}]];L0t3=Flatten[Thread[{Lbxt3,Lbyt3}]];Lt3=Join[L03,L0t3];

L04=Flatten[Thread[{Lbx4,Lby4}]];L0t4=Flatten[Thread[{Lbxt4,Lbyt4}]];Lt4=Join[L04,L0t4];

L05=Flatten[Thread[{Lbx5,Lby5}]];L0t5=Flatten[Thread[{Lbxt5,Lbyt5}]];Lt5=Join[L05,L0t5];

L06=Flatten[Thread[{Lbx6,Lby6}]];L0t6=Flatten[Thread[{Lbxt6,Lbyt6}]];Lt6=Join[L06,L0t6];

L07=Flatten[Thread[{Lbx7,Lby7}]];L0t7=Flatten[Thread[{Lbxt7,Lbyt7}]];Lt7=Join[L07,L0t7];

L08=Flatten[Thread[{Lbx8,Lby8}]];L0t8=Flatten[Thread[{Lbxt8,Lbyt8}]];Lt8=Join[L08,L0t8];

L0=Join[Lt1,Lt2,Lt3,Lt4,Lt5,Lt6,Lt7,Lt8];

Lb1=Flatten[Thread[{Phx1,Phy1}]];Lbt1=Flatten[Thread[{Phxt1,Phyt1}]];Lpt1=Join[Lb1,Lbt1];

Lb2=Flatten[Thread[{Phx2,Phy2}]];Lbt2=Flatten[Thread[{Phxt2,Phyt2}]];Lpt2=Join[Lb2,Lbt2];

Lb3=Flatten[Thread[{Phx3,Phy3}]];Lbt3=Flatten[Thread[{Phxt3,Phyt3}]];Lpt3=Join[Lb3,Lbt3];

Lb4=Flatten[Thread[{Phx4,Phy4}]];Lbt4=Flatten[Thread[{Phxt4,Phyt4}]];Lpt4=Join[Lb4,Lbt4];

Lb5=Flatten[Thread[{Phx5,Phy5}]];Lbt5=Flatten[Thread[{Phxt5,Phyt5}]];Lpt5=Join[Lb5,Lbt5];

Lb6=Flatten[Thread[{Phx6,Phy6}]];Lbt6=Flatten[Thread[{Phxt6,Phyt6}]];Lpt6=Join[Lb6,Lbt6];

Lb7=Flatten[Thread[{Phx7,Phy7}]];Lbt7=Flatten[Thread[{Phxt7,Phyt7}]];Lpt7=Join[Lb7,Lbt7];

Lb8=Flatten[Thread[{Phx8,Phy8}]];Lbt8=Flatten[Thread[{Phxt8,Phyt8}]];Lpt8=Join[Lb8,Lbt8];

MatrixForm[Lb=Join[Lpt1,Lpt2,Lpt3,Lpt4,Lpt5,Lpt6,Lpt7,Lpt8]]];

"Matrix L = "MatrixForm[L=L0-Lb];

Nor=Transpose[A].P.A//N;U=Transpose[A].P.L//N;X=-Inverse[Nor].U//N;

"Xa="MatrixForm[Xa=aprox+X];

V=Partition[A.X+L,1];VtPV=Transpose[V].P.V;

st=Flatten[VtPV/((cp*2*8+cpt*2*8)-193)];Simaxy=st[[1]]*Inverse[Nor];Tr[Simaxy,Varian];

```

Xa11=Xa[{1,2,3}];Xa12=Xa[{4,5,6}];Xap1=Join[Xa11" rad",Xa12" m"];
Xa21=Xa[{7,8,9}];Xa22=Xa[{10,11,12}];Xap2=Join[Xa21" rad",Xa22" m"];
Xa31=Xa[{13,14,15}];Xa32=Xa[{16,17,18}];Xap3=Join[Xa31" rad",Xa32" m"];
Xa41=Xa[{19,20,21}];Xa42=Xa[{22,23,24}];Xap4=Join[Xa41" rad",Xa42" m"];
Xa51=Xa[{25,26,27}];Xa52=Xa[{28,29,30}];Xap5=Join[Xa51" rad",Xa52" m"];
Xa61=Xa[{31,32,33}];Xa62=Xa[{34,35,36}];Xap6=Join[Xa61" rad",Xa62" m"];
Xa71=Xa[{37,38,39}];Xa72=Xa[{40,41,42}];Xap7=Join[Xa71" rad",Xa72" m"];
Xa81=Xa[{43,44,45}];Xa82=Xa[{46,47,48}];Xap8=Join[Xa81" rad",Xa82" m"];
Xat1=Xa[{49,50,51}]]" m";Xat2=Xa[{52,53,54}]]" m";Xat3=Xa[{55,56,57}]]" m";
Xat4=Xa[{58,59,60}]]" m";Xat5=Xa[{61,62,63}]]" m";Xat6=Xa[{64,65,66}]]" m";
Xat7=Xa[{67,68,69}]]" m";Xat8=Xa[{70,71,72}]]" m";Xat9=Xa[{73,74,75}]]" m";
Xat10=Xa[{76,77,78}]]" m";Xat11=Xa[{79,80,81}]]" m";Xat12=Xa[{82,83,84}]]" m";
Xat13=Xa[{85,86,87}]]" m";Xat14=Xa[{88,89,90}]]" m";Xat15=Xa[{91,92,93}]]" m";
Xat16=Xa[{94,95,96}]]" m";Xat17=Xa[{97,98,99}]]" m";Xat18=Xa[{100,101,102}]]" m";
Xat19=Xa[{103,104,105}]]" m";Xat20=Xa[{106,107,108}]]" m";Xat21=Xa[{109,110,111}]]" m";
Xat22=Xa[{112,113,114}]]" m";Xat23=Xa[{115,116,117}]]" m";Xat24=Xa[{118,119,120}]]" m";
Xat25=Xa[{121,122,123}]]" m";Xat26=Xa[{124,125,126}]]" m";Xat27=Xa[{127,128,129}]]" m";
Xat28=Xa[{130,131,132}]]" m";Xat29=Xa[{133,134,135}]]" m";Xat30=Xa[{136,137,138}]]" m";
Xat31=Xa[{139,140,141}]]" m";Xat32=Xa[{142,143,144}]]" m";Xat33=Xa[{145,146,147}]]" m";
Xat34=Xa[{148,149,150}]]" m";Xat35=Xa[{151,152,153}]]" m";Xat36=Xa[{154,155,156}]]" m";
Xat37=Xa[{157,158,159}]]" m";Xat38=Xa[{160,161,162}]]" m";Xat39=Xa[{163,164,165}]]" m";
Xat40=Xa[{166,167,168}]]" m";Xat41=Xa[{169,170,171}]]" m";Xat42=Xa[{172,173,174}]]" m";
Xat43=Xa[{175,176,177}]]" m";Xat44=Xa[{178,179,180}]]" m";Xat45=Xa[{181,182,183}]]" m";
Xat46=Xa[{184,185,186}]]" m";Xat47=Xa[{187,188,189}]]" m";Xat48=Xa[{190,191,192}]]" m";

```

Output

```

(* Print["Photo1 = "MatrixForm[Xap1]," Photo2 = "MatrixForm[Xap2]] *)
(* Print["Photo3 = "MatrixForm[Xap3]," Photo4 = "MatrixForm[Xap4]] *)
(* Print["Photo5 = "MatrixForm[Xap5]," Photo6 = "MatrixForm[Xap6]] *)
(* Print["Photo7 = "MatrixForm[Xap7]," Photo8 = "MatrixForm[Xap8]] *)
(* Print["Internal = "MatrixForm[Xai]," VtPV = "[VtPV]] *)
Print["TiePoint1 = "MatrixForm[Xat1]," TiePoint2 = "MatrixForm[Xat2]]

```

```

Print["TiePoint3 = "MatrixForm[Xat3]," TiePoint4 = "MatrixForm[Xat4]]
Print["TiePoint5 = "MatrixForm[Xat5]," TiePoint6 = "MatrixForm[Xat6]]
Print["TiePoint7 = "MatrixForm[Xat7]," TiePoint8 = "MatrixForm[Xat8]]
Print["TiePoint9 = "MatrixForm[Xat9]," TiePoint10 = "MatrixForm[Xat10]]
Print["TiePoint11 = "MatrixForm[Xat11]," TiePoint12 = "MatrixForm[Xat12]]
Print["TiePoint13 = "MatrixForm[Xat13]," TiePoint14 = "MatrixForm[Xat14]]
Print["TiePoint15 = "MatrixForm[Xat15]," TiePoint16 = "MatrixForm[Xat16]]
Print["TiePoint17 = "MatrixForm[Xat17]," TiePoint18 = "MatrixForm[Xat18]]
Print["TiePoint19 = "MatrixForm[Xat19]," TiePoint20 = "MatrixForm[Xat20]]
Print["TiePoint21 = "MatrixForm[Xat21]," TiePoint22 = "MatrixForm[Xat22]]
Print["TiePoint23 = "MatrixForm[Xat23]," TiePoint24 = "MatrixForm[Xat24]]
Print["TiePoint25 = "MatrixForm[Xat25]," TiePoint26 = "MatrixForm[Xat26]]
Print["TiePoint27 = "MatrixForm[Xat27]," TiePoint28 = "MatrixForm[Xat28]]
Print["TiePoint29 = "MatrixForm[Xat29]," TiePoint30 = "MatrixForm[Xat30]]
Print["TiePoint31 = "MatrixForm[Xat31]," TiePoint32 = "MatrixForm[Xat32]]
Print["TiePoint33 = "MatrixForm[Xat33]," TiePoint34 = "MatrixForm[Xat34]]
Print["TiePoint35 = "MatrixForm[Xat35]," TiePoint36 = "MatrixForm[Xat36]]
Print["TiePoint37 = "MatrixForm[Xat37]," TiePoint38 = "MatrixForm[Xat38]]
Print["TiePoint39 = "MatrixForm[Xat39]," TiePoint40 = "MatrixForm[Xat40]]
Print["TiePoint41 = "MatrixForm[Xat41]," TiePoint42 = "MatrixForm[Xat42]]
Print["TiePoint43 = "MatrixForm[Xat43]," TiePoint44 = "MatrixForm[Xat44]]
Print["TiePoint45 = "MatrixForm[Xat45]," TiePoint46 = "MatrixForm[Xat46]]
Print["TiePoint47 = "MatrixForm[Xat47]," TiePoint48 = "MatrixForm[Xat48]]
Print["VtPV = "[VtPV]]
Tr[Sqrt[Simaxy],Standard]

```

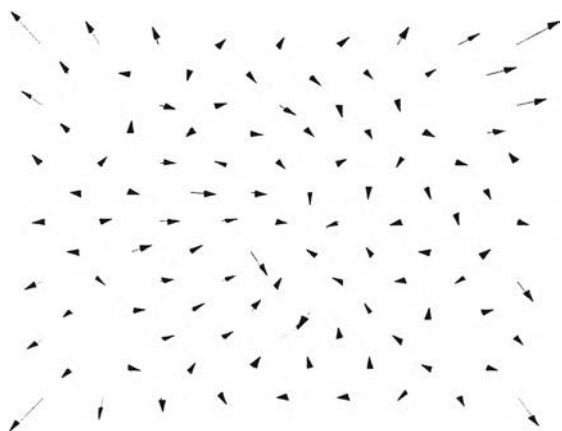
$$\begin{array}{l}
 \text{TiePoint1} = \begin{pmatrix} 4.90852 \text{ m} \\ 5.06524 \text{ m} \\ 0.000495803 \text{ m} \end{pmatrix} \quad \text{TiePoint2} = \begin{pmatrix} 4.93445 \text{ m} \\ 5.06544 \text{ m} \\ 0.000117964 \text{ m} \end{pmatrix} \\
 \text{TiePoint3} = \begin{pmatrix} 4.9606 \text{ m} \\ 5.06564 \text{ m} \\ -0.000578688 \text{ m} \end{pmatrix} \quad \text{TiePoint4} = \begin{pmatrix} 4.98687 \text{ m} \\ 5.06572 \text{ m} \\ -0.00092781 \text{ m} \end{pmatrix} \\
 \text{TiePoint5} = \begin{pmatrix} 5.01317 \text{ m} \\ 5.06567 \text{ m} \\ -0.00023429 \text{ m} \end{pmatrix} \quad \text{TiePoint6} = \begin{pmatrix} 5.03942 \text{ m} \\ 5.06563 \text{ m} \\ 0.000032114 \text{ m} \end{pmatrix} \\
 \text{TiePoint7} = \begin{pmatrix} 5.06545 \text{ m} \\ 5.06546 \text{ m} \\ -0.000170381 \text{ m} \end{pmatrix} \quad \text{TiePoint8} = \begin{pmatrix} 5.09162 \text{ m} \\ 5.06539 \text{ m} \\ -0.000547214 \text{ m} \end{pmatrix}
 \end{array}$$

Error Graphic Eight Photo

```
<<Graphics`PlotField`
```

```
var1 = {{{4.9083,5.0655},{-0.0002197,0.0002585}*s},{{4.9345,5.0655},{0.0000463,0.0000588}*s},
{{4.9607,5.0655},{0.0001034,-0.0001358}*s},{{4.9869,5.0655},{0.0000251,-0.0002161}*s},
{{5.0131,5.0655},{-0.0000656,-0.0001681}*s},{{5.0393,5.0655},{-0.0001183,-0.0001257}*s},
{{5.0655,5.0655},{0.0000542,0.0000433}*s},{{5.0917,5.0655},{0.0000785,0.0001094}*s},
{{4.9083,5.0393},{-0.0000218,0.0000680}*s},{{4.9345,5.0393},{0.0002367,-0.0000426}*s},
{{4.9607,5.0393},{0.0001778,-0.0001770}*s},{{4.9869,5.0393},{-0.0000761,-0.0002866}*s},
{{5.0131,5.0393},{-0.0000493,-0.0001670}*s},{{5.0393,5.0393},{-0.0002463,-0.0001374}*s},
{{5.0655,5.0393},{-0.0001971,-0.0000146}*s},{{5.0917,5.0393},{0.0000473,0.0000444}*s},
{{4.9083,5.0131},{0.0000002,-0.0000300}*s},{{4.9345,5.0131},{0.0002555,-0.0000867}*s},
{{4.9607,5.0131},{0.0002288,-0.0001185}*s},{{4.9869,5.0131},{0.0000722,-0.0000746}*s},
{{5.0131,5.0131},{-0.0000684,-0.0000870}*s},{{5.0393,5.0131},{-0.0002564,-0.0000672}*s},
{{5.0655,5.0131},{-0.0002533,0.0000162}*s},{{5.0917,5.0131},{-0.0000956,0.0000398}*s},
{{4.9083,4.9869},{-0.0000230,-0.0000250}*s},{{4.9345,4.9869},{0.0002553,0.0000371}*s},
{{4.9607,4.9869},{0.0002532,0.0001300}*s},{{4.9869,4.9869},{0.0003918,0.0002754}*s}}
```

```
ListPlotVectorField[var1]
```



```
- Graphics -
```

ประวัติผู้เขียนวิทยานิพนธ์

นายกนกศักดิ์ ช่อธนาวงศ์ เกิดเมื่อวันที่ 7 มิถุนายน พ.ศ. 2514 สำเร็จการศึกษาปริญญาตรีสถาบันเทคโนโลยีพระจอมเกล้าธนบุรี ภาควิชาครุศาสตร์โยธา คณะครุศาสตร์อุตสาหกรรม ในปีการศึกษา 2538 และเข้าศึกษาต่อในหลักสูตรวิศวกรรมศาสตรมหาบัณฑิต สาขาวิศวกรรมสำรวจที่ จุฬาลงกรณ์มหาวิทยาลัย ในปีการศึกษา 2541

