PARACLINIC INVESTIGATION METHOD OF STATIC DEFORMATION HUMAN LEG

Sef lucr. ing. Ovidiu SPĂTARI
Universitatea "Lucian Blaga" Sibiu, Facultatea de Inginerie, Str. Emil Cioran nr.4, 2400, SIBIU
e-mail: ovidiu.spatar@ulbsibiu.ro

Prof. dr. ing. Anton POLICEC
Universitatea "Politehnica" Timisoara, Facultatea de Electronica si Telecomunicatii,
Str. Vasile Parvan nr.2, Timisoara

Abstract: The method present in this study to permit determination a static deformities parameter of plantar surface. As measurement device was use one matrix surface on pressure transducers with one dimension for 18x10cm and with two-sensor/cm^2 density. Acquisition data system to contain selection circuits of transducers, matrix read circuits, conversion and interfaces. Using multiplexes techniques were obtained plantar diagrams for five subjects with different characteristics of age, weight and sex. the study was made in 150 measurement points it has as propose in the first case the detection, monitoring and correction main static deformities- "echin" leg, "varus, talus and also associated static deformities- "varus-echin", "talus-valgus", etc. The necessary accessible data on the PC parallel port are structured in .txt files and them processed by a Matlab program.

Key words: *deformities parameters, plantar surface, pressure transducers, and plantar diagram.*

INTRODUCTION:

Point of view of biomechanics toe support high alternative pressure in static and gait. Toe disease be condition as structural possibility of transverse bridge as harmonious adapt of gait. One unbalance appearance through general solicitation or local of anterior leg to lead vicious static with functional deficit at adults. Flat leg and valgus postural leg be characterized about longitudinal and transversal bridge lack. Flat leg was meet at kids and adults who be long professional effort or at the supra weigh. The method present in this study to permit determination a static deformities parameter of plantar surface.

Symptom and pathology

main static deformities

- "echin" leg – high pressure on metatarsian base and low pressure on plantar surface
- "varus" leg – high pressure on exterior size (fig.2)
- "talus" leg – high pressure on heel and low pressure on plantar surface (fig.2)
- "valgus" leg - high pressure on interior size
- "flat" leg - high pressure on complete plantar surface (fig.1)

static deformities associate

- **"valgus-echin"** leg - low pressure on plantar surface associate with high pressure on interior size
- **"talus-values"** leg - high pressure on heel and low pressure on plantar surface associate with high pressure on interior size

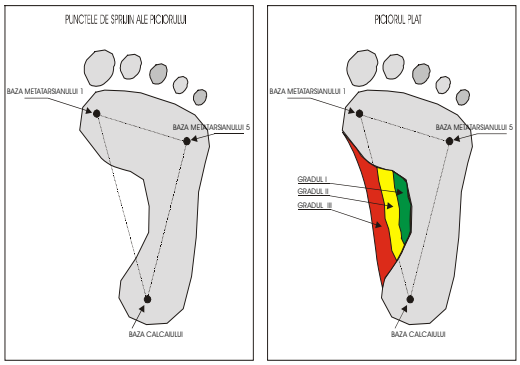


fig. 1

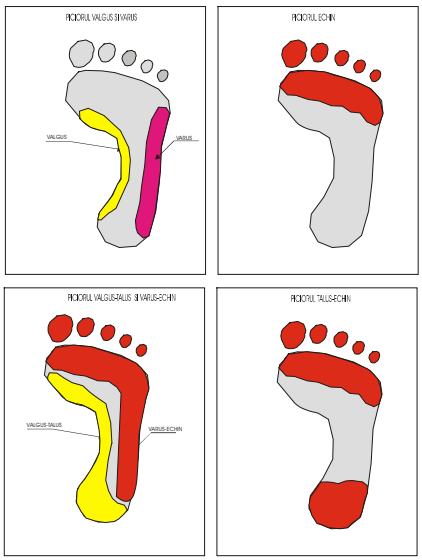


fig.2

ACQUISITION DATA SYSTEM

.As measurement device was use one matrix surface on pressure transducers with one dimension for 18x10cm and with two-sensor/cm^2 density. Acquisition data system to contain selection circuits of transducers, matrix read circuits, conversion and interfaces. Using multiplexes techniques were obtained plantar diagrams for five subjects with different characteristics of age, weight and sex. The study was made in 150 measurement points it has as propose in the first case the detection, monitoring and correction main static deformities. In device construction be use piezoresitiv sensors (fig.3).

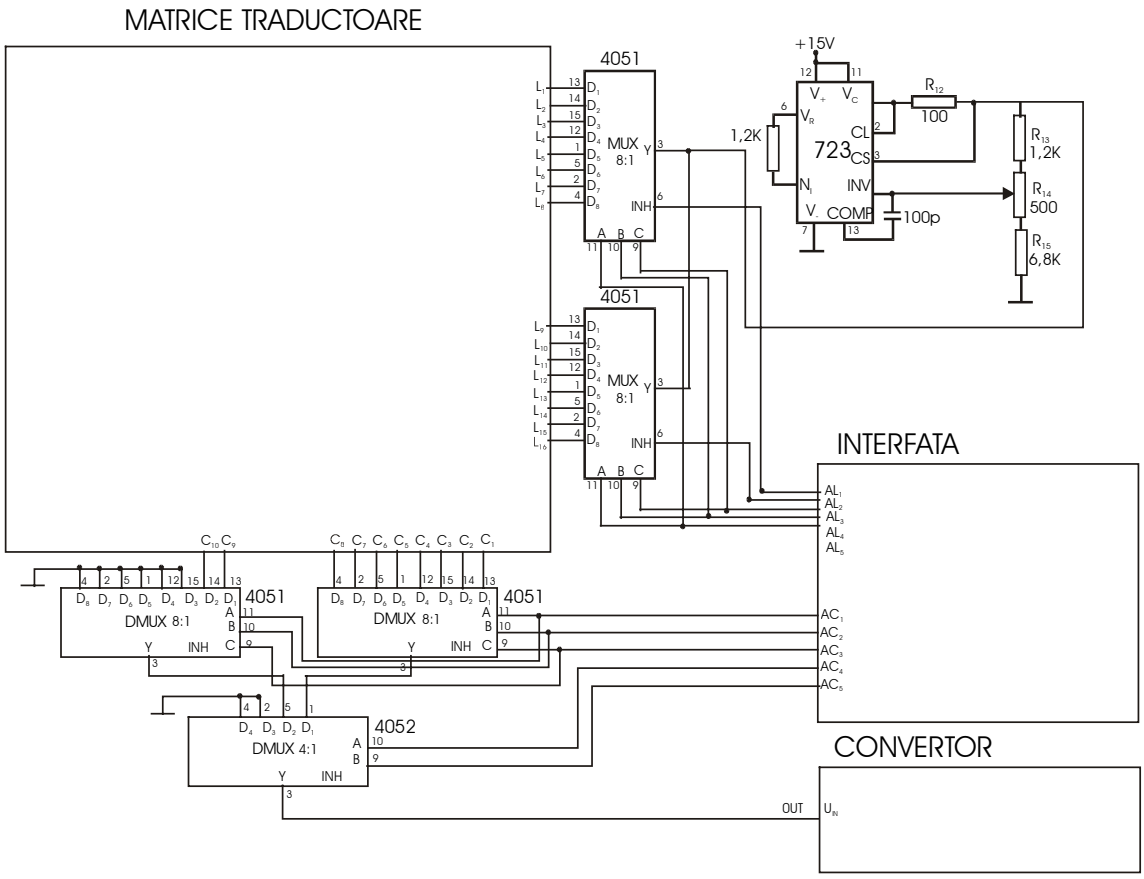


fig.3

DATA PROCESSING

Accessible data on the PC parallel port are structured in .txt files and them processed by a Matlab program.

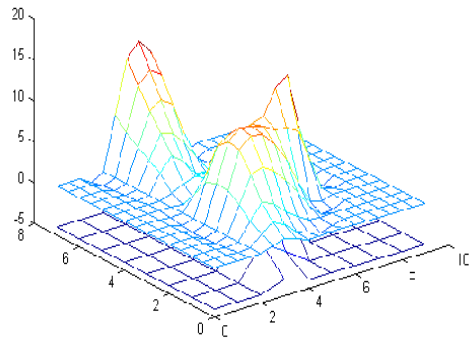
PLANTAR DIAGRAM 1(subject 1)

```
A=[1,1,1,2,1,1,1,1,1,1
1,1,1,5,3,1,1,1,1,1
1,1,1,10,11,7,1,1,1,1
1,1,1,9,10,11,15,1,1,1
1,1,1,1,5,2,1,1,1,1
1,1,1,5,2,1,1,1,1,1
1,1,1,9,9,1,1,1,1,1
1,1,1,14,14,1,1,1,1,1];
Ai=interp2(A,'*cubic');
M=max(max(Ai)); m=min(min(Ai));
a=['Presiunea maxima =' num2str(M) ]
b=['Presiunea minima =' num2str(m) ]
[l,c]=size(A); x=0:l-1; x= x'; y=0:c-1;
[li, ci]=size(Ai);
xi=0:(l-1)/(li-1):l-1; xi= xi';
yi=0:(c-1)/(ci-1):c-1;
mesh(y,x,A-5); hold on
mesh(yi, xi,Ai); grid
presiunea maxima=15,625
presiunea minima=0,125
```

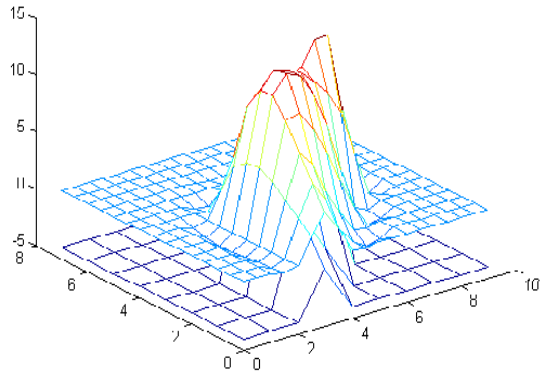
PLANTAR DIAGRAM 2 (subject 2)

```
A=[1,1,1,5,1,1,1,1,1,1
1,1,1,9,5,1,1,1,1,1
1,1,1,13,14,9,1,1,1,1
1,1,1,11,12,13,15,1,1,1
1,1,1,1,5,2,1,1,1,1
1,1,1,1,1,1,1,1,1,1
1,1,1,1,1,1,1,1,1,1
1,1,1,1,1,1,1,1,1,1];
Ai=interp2(A,'*cubic');
M=max(max(Ai)); m=min(min(Ai));
a=['Presiunea maxima =' num2str(M) ]
b=['Presiunea minima =' num2str(m) ]
[l,c]=size(A); x=0:l-1; x= x'; y=0:c-1;
[li, ci]=size(Ai);
xi=0:(l-1)/(li-1):l-1; xi= xi';
yi=0:(c-1)/(ci-1):c-1;
mesh(y,x,A-5); hold on
mesh(yi, xi,Ai); grid
presiunea maxima=15,000
presiunea minima=0,005
```

Plantar diagrams

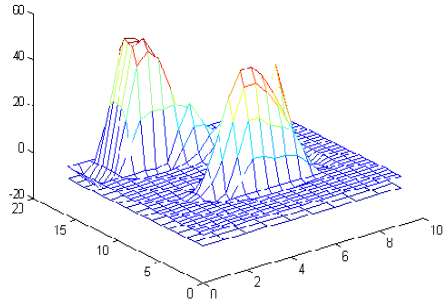


subject 1

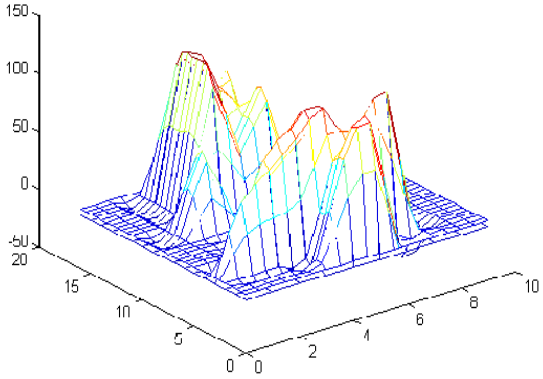


subject 2

subject 3



subject 4



CONCLUSIONS:

SUBJECT 1:

X[cm]=10 V=3 yars
Y[cm]=8 P= static
Z[Kg]= G= max. 20Kg G=15Kg
a =maxim pressure =15.625
b =minim pressure =0.125

Plantar diagram for subject 1 to be characterized by high pressure on inside and outside plantar extremity. This deformation is evidence and gait case. Results is established by high pressure point determination. In accordance with this results, subject 1 to produce "valgus-echin" leg.

SUBJECT2:

X[cm]=10 V=33 yars
Y[cm]=17 P= static
Z[Kg]= G= max. 110Kg G=100Kg
H[m]=1.85 MP=45
a= maxim pressure = 110,97
b= minim pressure =10,211

Plantar diagram to produce for subject 2 one toe with low "varus" action. This deformation not evidence in gait case.

SUBJECT3:

X[cm]=10 V=31 yars
Y[cm]=17 P= static
Z[Kg]= G= max. 65Kg G=62Kg
H[m]=1.65 MP=35
a= maxim pressure =54,355
b= minim pressure = 5,322

Deformation not evidence.

SUBJECT4:

X[cm]=10 V=70 yars
Y[cm]=17 P= static
Z[Kg]= G= max. 150Kg G=130Kg
H[m]=1.85 MP=44

a= maxim pressure =127,144
b= minim pressure = 11,254

Plantar diagram to produce for subject 4 "round leg" with high evidence of "flat-leg".

REFERENCES:

[1] Glitsch U., The three-dimensional determination of internal loads in the lower extremity, Jurnal of Biomechanics, 1997, vol.30

[2] Anderson F.C., Static and dynamic optimization for gait are practically aquivalent, Jurnal of Biomechanics, 2000, vol.35

[3] J.G.Proakis,ş.a., Advanced Digital Signal Processing, Principles, Algorithms and Application, Macmillan Pb.Co, 1992.

[4] Enatescu V., Barth L., Suciu V., Traductorii laboratorului de informatica medicala: sisteme de captare biomecanice, electronoptice, fonice si de biopotentiale, Al V lea Simpozion de Electronica medicala, Cluj, 1994