INNOVATIVE TECHNOLOGY : Research, Formation, Innovation

INNOVATIVE TECHNOLOGY (IN-TECH) was founded by a French physician for development in engineering (instrumentation), signal processing (acquisition and analysis software), and training (know-how) to meet the needs of personnel working in research, medicine, health-related activities, athletics, and education.

IN-TECH specializes in designing technology to study and measure posture and balance. The Company provides ready-to-use as well as made-to-order products for all postural and balance purposes.

1) STATIC AND DYNAMIC STABILOMETRY

a) Single-plate platform:

IN-TECH's patented ultra-lightweight single-plate force platform meets the Metrologic requirements of the French Posturology Association (AFP 85/2000 Standards).

b) Dual « Bi-Pod» platform:

The dual « bi-pod » platform consisting of one single-plate force platform for each foot is a precision tool for measuring the respective contribution of heel and hip muscles on each side of the body to maintaining postural equilibrium. This type of investigation is not possible with one single-plate force platform.

Specifications and features of the Bi-Pod™ platform

In full conformity with AFP 85 and AFP 2000 standards: 16+ bits, 40Hz.

- Dual force platforms linked via a patented coupling mechanism.
- 6 degrees of freedom: 3 for each foot.
- Constructs a global statokinesigram (STKG) by combining unilateral STKG.
- Any of the 3 STKG can be selected for data processing.
- Calculation of STKG regardless of foot position.
- Compact, lightweight construction (3 Kg).
- Tempered glass panels with footprint pattern on the underside for easy aseptization.

c) Single footprint force platforms (Sabots):

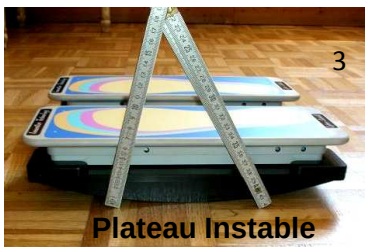
IN-TECH's dynamometric sabots (registered patent 1999) and Cyber-Sabots™ (registered patent 2006) invented by Maurice Ouaknine are uncoupled force platforms (one for each foot). Each platform provides separate measurement of forces distributed between the heel and forefoot. This novel approach that has no precedent in posturology opens the way to new concepts, methods, and parameters for enhanced postural assessment. IN-TECH's exclusivity agreement includes quality assurance that guarantees users stringent conformity of hardware, software, and updates with inventor's recommendations.

Specifications and features of Cyber-Sabots™

Milled entirely from a single block of aviation-quality metal alloy, Cyber-Sabots feature excellent mechanical properties: sturdy, compact, lightweight, and reduced heat sensitivity. The system is available in several anodized finish tones.

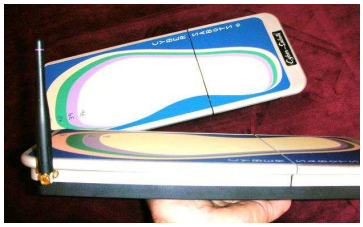
New: 50% thinner and lighter

The platform surface is specially designed to ensure thermal and electrical insulation and carries a footprint pattern to assist proper foot placement in function of the subject's foot size.



New: Low-profile «Bessou» platform

The rocking platform, a.k.a. « Bessou » unstable platform, is the result of careful study to meet the requirements of the Toulouse school:
1) Maintain curve radius.
2) Allow sagittal and frontal control of sabots.
3) Maintain plantar arch at a constant height of 60 mm.
Thanks to the low-profile design, Toulouse school requirements have been fully satisfied.



Selected options

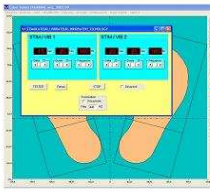
Cyber-Sabots can be equipped with various options including:

- Device to measure relative foot position/orientation (PO).
- «Bessou» platform.
- Piezo-electric touch-sensitive surface.
- Bluetooth wireless connection (photo: Cyber-Sabots with antenna customized for archery).

Built-in processor

A powerful built-in processor unit ensures data acquisition and interface with a PC computer. The processor is powered from the USB port. Exchange between the «Master» and «Slave» cards is fully digital. The A/D convertors feature 24-bit resolution, 5000 Hz aquisition frequency, and adjustable gain. The anti-aliasing filters adjust automatically in function of the pass-band chosen.

2) MECHANICAL VIBRATORY STIMULATOR



Electromechanical stimulators for laboratory use

IN-TECH offers a choice of long-life brushless electric motors of various sizes and intensity depending on the required frequency of the vibration. The built-in electronic components allow servo control with less than 1% frequency error. IN-TECH motors come in several power ratings and sizes with diameters from 8 (needle) to 32 mm.

Control units (UNIT_VIV2 and VIB4) can handle 2 or 4 motors. In the programmed mode the computer is in full control.

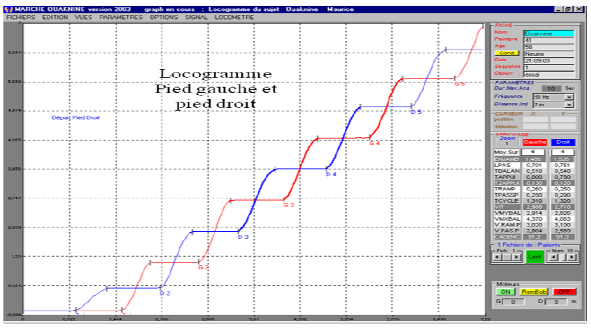
N.B. The data processing software provided with the Cyber-Sabots system features a stimulation window allowing parameterization (delay, duration, frequency, frequency profile, etc.) for up to 4 motors during stabilometric recording.

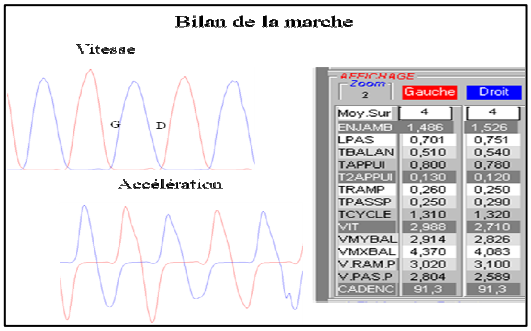
3) SOFTWARE

a) Locomotion:

IN-TECH offers dedicated software for kymographic analysis of walking and running gait: «LOCOWIN» and «LOCODYN» respectively. «LOCOWIN» allows full assessment of gait parameters based on the position of each foot in relation to a fixed, relative, or alternating reference point. «LOCOWIN» is particularly suited to use with wire locometers. IN-TECH custom-builds locometers in accordance with Toulouse School recommendations. «LOCODYN», allows overall (bilateral) or separate (unilateral) measurement of acceleration as well as foot direction in relation to the direction of the earth's magnetic pull.

Walking Balance: Locowin

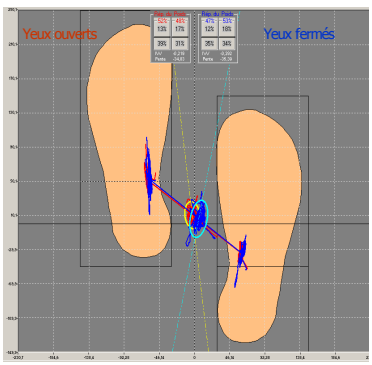




b) Stabilometric analysis:

IN-TECH's «POSTUROLAB» software is designed to analyze data from the single-plate force platform. This application is based on more than 20 years of experience and includes all standardized parameters described in AFP 12/05 and AFP 40/16 standards. For further information, refer to the 8-lesson series published by the Association Posture & Equilibre (APE).

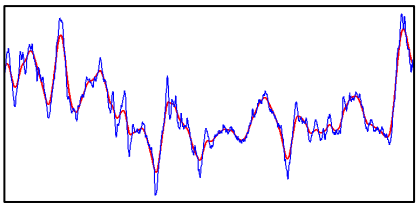
IN-TECH holds exclusive distribution rights for Cyber-Sabots as well as for the «SABOTSOFT» software designed specifically for processing data collected using the Cyber-Sabots. In addition to standardized parameters, SABOTSOFT provides a wide range of data as illustrated by the following graphs:



Statokinesigrams and related confidence ellipses

By comparing statokinesigrams (STKG) made under different conditions (eyes open vs. eyes closed) and in relation to foot position (standardized vs. free), users can obtain a range of valuable information including:

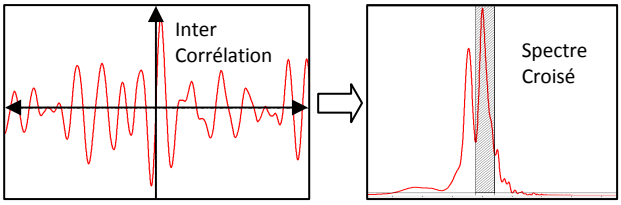
- Mean placements of unilateral and bilateral STKG in relation to feet.
- Weight distribution in relation to 4 pressure points on the foot.
- Notion of support foot, drive foot, weight-bearing foot, and leading foot.
- Estimation of the amplitude of oscillation in both directions (surface and elliptical form).
- Comparison of parameters under both conditions (eyes open vs. eyes closed).
- Estimation of the mean general direction of oscillations (slope of ellipse).



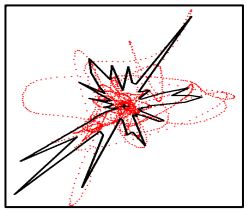
Center of Pressure and Center of Mass

Using an Ad-Hoc procedure, SABOTSOFT estimates the center of pressure (blue) and center of weight (red). By superposing these two traces it is possible to determine the mechanical forces necessary to right balance of the body weight center in case of destabilization (falling) or when getting up (standing).

Normal and excess control of oscillations: Spectral density of interaction

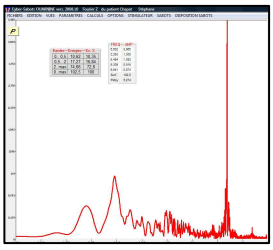


The AP/ML inter-correlation implies a correlation between AP and ML oscillations. Despite the ample pseudoperiodic aspect of this function (left), these movements are controlled and anticipated. They can therefore involve simulation. In that case the interaction energy exhibited in the 0.3 Hz band of the interspectrum (right) will be greater than 60%.



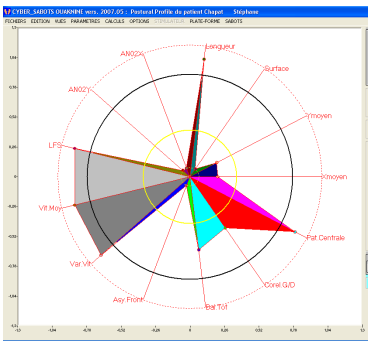
Vectogram of the Center of Pressure and Center of Mass

Distribution of velocity vectors into sectors around the point of origin is useful to highlight the peculiarities and limitations of the single-articulation inversed pendulum model. Velocity direction shows characteristic variations depending on foot position, functional impairment (nonalignment of ankle axes) or malformation (short leg, etc). The figure presented here shows a center of weight vectogram (dotted line).
N.B. This graphic representation is different from the sectorial position histogram.

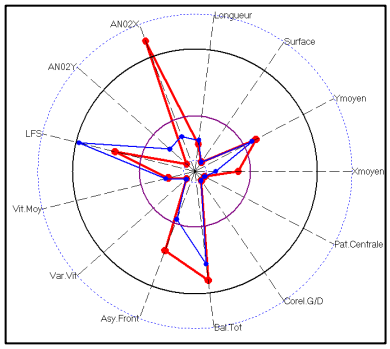


Spectrum of vertical forces

The FFT of the total vertical force (Z(t)) is sensitive to velocity and acceleration of high-frequency vertical movements. Tremors that do not appear on FFTX or FFTY can sometimes be detected and thus allow diagnosis of neurological disease. The figure presented here shows a large peak around 7 Hz that confirms a neurological condition.



Postural Profile© on a posturogram

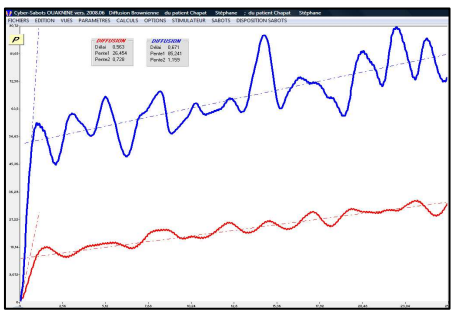


Comparison of profile before (red) and after (blue) treatment clearly shows improvement

Postural Profile©

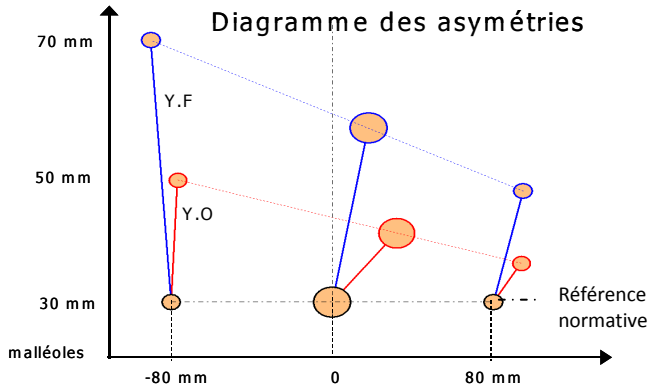
Indicators of postural instability can constitute a overwhelming mass of information for clinicians. Postural Profile© was developed as a tool to assist the clinician in interpreting the posturogram.

Postural Profile© provides a composite representation of the patient's postural evaluation. This display mode allows the clinician to identify the most meaningful postural parameters at a single glance by recapping key data including precision, energy expenditure, symmetry, muscle tension, degree of freedom, and relation to the different sensors.



Brownian diffusion

By assimilating the STKG with Brownian movement, Collins and De Luca demonstrated a break in the slope of diffusion curves. The break point, designated critical time (Tc), is the point of separation between two processes in the postural control sequence. For times shorter than Tc, the process is persistent and control is achieved in an open loop. For times longer than Tc, the process becomes non persistent and control is achieved in a closed loop. In most cases control is shorter when testing is carried out with the eyes closed. Useful parameters include Tc time and the slopes of the two regression lines on the curves on either side of the Tc abscissa point.



Asymmetry Diagram

Asymmetry diagrams are designed to detect asymmetry in relation to the mean position of the center of pressure. The reference standard is obtained by statistical calculation of the position of the mean center of pressure in a control population. Positional and directional displacements are determined in relation to vectors originating from the standard point and ending at the real center of pressure. In the figure presented on the left, both the eyes open (red) and eyes closed (blue) recordings place the means in front of the reference standard (approximately +30 mm in front of the malleolar axis). Asymmetry is more pronounced on the eyes closed recording.

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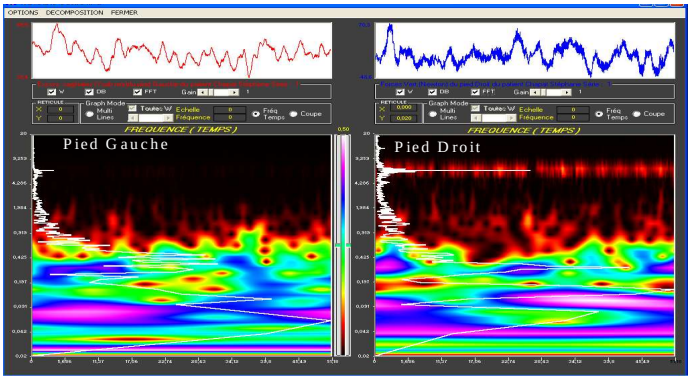
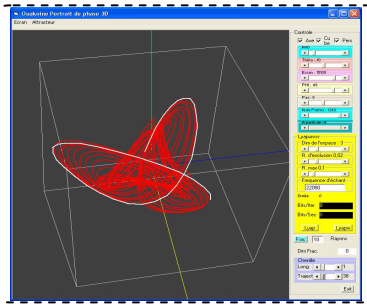


Wavelet display mode

The wavelet display mode provides a time-frequency trace of the stabilometric signal. Wavelets can be compared to a FFT displayed in a ticker signal window. Representation is three-dimensional (time-frequency-intensity). Single plane presentation is the preferred mode in most cases. Intensity is indicated by the conventional temperature color coding method.

The two figures on the left show wavelets in comparison with sagittal excursions for each foot. A 6.62 Hz tremor confirmed by the superposed FFT is confined to the right foot. This display technique is useful for analyzing posture sequence.



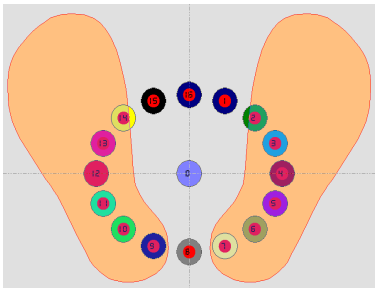
Chaos evaluation module

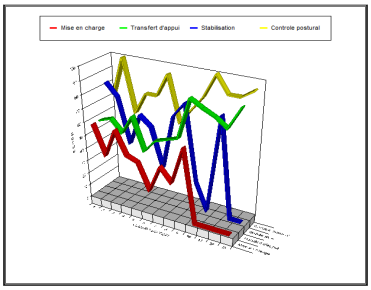
This display module is available in some versions of SABOTSOFT mainly for research purposes. Recent breakthroughs in the field of nonlinear dynamics are applicable to postural analysis. This construction technique produces a phase space image (1 to 10 dimensions) from a temporal series (stabilogram).

The characteristic fractal dimension of this phase space allows estimation of degree of freedom and dynamics. Other useful characteristics include degree of instability that can be easily determined by calculating Lyapunov exponents. The 3D object display allows the user to manipulate the image for viewing at every angle.

c) Rehabilitation and biofeedback:

IN-TECH's SABOTGAME is a gamelike application designed in accordance with the recommendations of Dr. BORGEL to assist in rehabilitation activities. SABOTGAME presents each phase of the postural exercises in a clearly understandable sequence that develops 5 skills: loading, transfer of weight, stabilization, postural space, and postural control.





Rehabilitation: SabotGame

SabotGame is designed to assist postural rehabilitation therapy using biofeedback. It can be used with the standard platform, Cyber-Sabots, the Bi-Pod system and the unstable «BESSOU» platform.

The purpose of this rehabilitation software is to provide the user with visual and audio feedback for assessing the position of his center of pressure.

The patient's performance is presented in the form of tables and selection of 16 graphs.

Declaration of conformity:

The hardware described above and accompanying software are compatible with the following:
European requirements for conventional medical devices in accordance with directive 93/42/CEE, annex VII.
Low Voltage Directive 73/23/CE and amendments.
Directives concerning Electromagnetic conformity 89/336/CE and amendments.

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