PROTRUDE REWARMING FOR CLINICAL PRACTICE

Beate Meffert, O. Hochmuth, Antje Wenzel, M. Steiner

Department of Electrical Engineering, Humboldt University Berlin

ABSTRACT: Measuring of the rewarming of the skin is used in dermatology as diagnostic method for atopic dermatitis, sclerodermia and other skin deseases [1,2]. The method helps to examine pathological processes in and under the skin and is useful to improve the diagnostic value.

METHOD

After a one-minute local ice-shock to a finger (temperature decrease to about 12 °C) the rewarming of the skin is measured with a temperature measuring device and processed with a computer. Temperature measuring devices with radiation sensors fulfil in addition to the requirement of non-contact measurement the conditions of the spectral sensitivity in the range of 8 to 14 μm, the resolution of 0,1 °C and a measurement time of 250 ms. The measurement gives, dependent of the duration of rewarming, from 300 to 2000 samples.

The software for the determination of the so-called "time constant of rewarming" has to approximate the measured temperature curve. An exponential increase of the temperature is assumed. This recommends the description by means of a step function response of a delay network first or second order (see Fig. 1). The approximation is possible by differential procedures, turning tangent procedure, or by stochastic search procedures (Monte Carlo method) [3].

The software (C++) consists of two parts, the program AWE for the measurement and storage of the data according to a standarized measuring regime. The desired time constant is determined by the second part of the software, the program TAU.

The software is suitable for IBM compatible PC, for EGA or VGA standard and requires 500 Kbyte memory space. Via Centronics interface the rewarming curve can be printed. The software for the clinical practice ist characterized by dialog capability, robustness and a simple user menu. For the physician engaged in research there are options for further processing algorithms, e.g. partitioning of the rewarming curve in two parts.

RESULTS

The test of the software with 32 patients showed that the Monte Carlo method is specially robustly and therefore preferable.
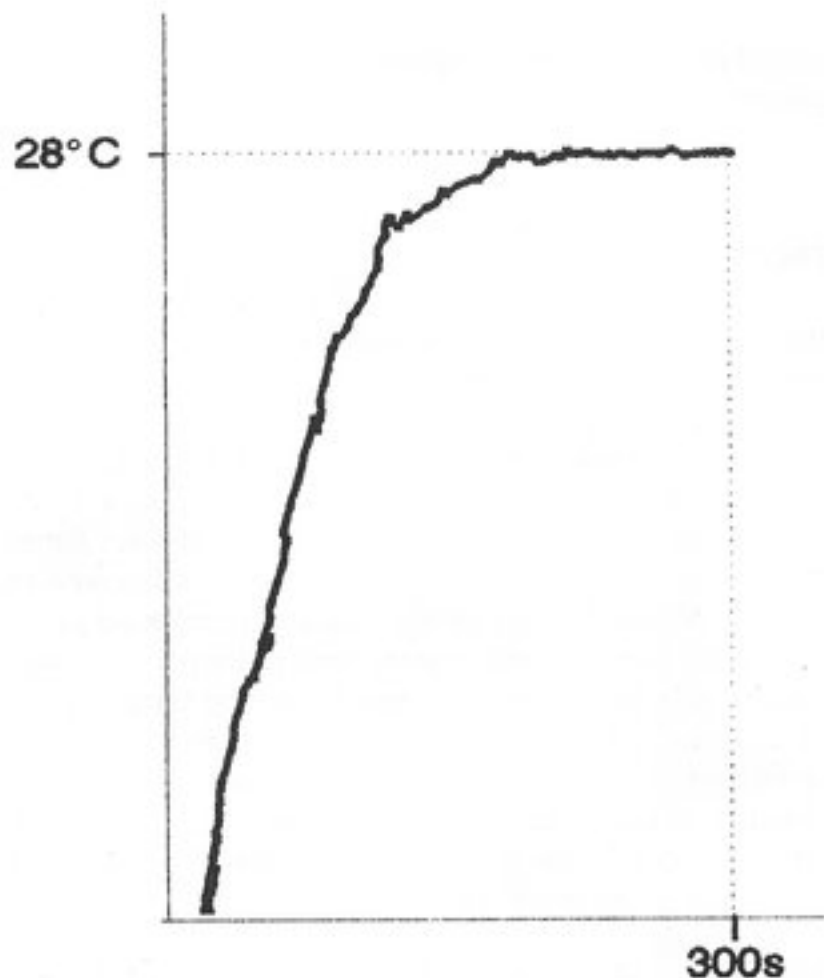

Fig. 1:   Typical rewarming curve first order

REFERENCES

[1] H. Meffert, N. Sönnichsen, B. Meffert: Skin rewarming curves. Lancet, No. 7780, p. 679, 1972

[2] H. Meffert, U. Lemke: Wiedererwärmung, Wärmeleitfähigkeit und Durchblutung der Haut bei Gesunden und Sklerodermiekranken. Dermatol. Monatsschrift, vol. 176, pp. 108-114, 1990

[3] U. Witzke: Stochastische Suchmethoden. Computertechnik, No. 7, pp. 182-187, 1991