Erkennung von Signalen motorischer Einheiten im Elektromyogramm

Author(s):
Erb, Karl Johannes

Publication Date:
1978

Permanent Link:
https://doi.org/10.3929/ethz-a-000169046

Rights / License:
In Copyright - Non-Commercial Use Permitted
ERKENNUNG VON SIGNALEN

MOTORISCHER EINHEITEN

IM ELEKTROMYOGRAMM

Abhandlung
zur Erlangung des Titels eines
Doktors der technischen Wissenschaften
der
Eidgenössischen Technischen Hochschule Zürich

vorgelegt von
Erb, Karl Johannes
dipl. El.-Ing. ETH
geboren am 19. Juli 1946
von Winterthur (Kt. Zürich)

Angenommen auf Antrag von
Prof. Dr. G. S. Moschytz, Referent
Prof. Dr. med. G. Baumgartner, Korreferent

1978
ABSTRACT

A method for analyzing electromyographic signals is proposed, which estimates and detects potentials caused by active motor units in skeleton muscles and therefore allows the diagnosis of neurogenic and myogenic diseases (analysis of waveforms) as well as an investigation of the neuromuscular control-loop (analysis of point processes given by the activation of single motor units). The algorithm was developed - as an extension of existing methods - for improved performance at fairly high innervation levels, when different motor units frequently overlap. Motor unit potentials are determined empirically and continuously improved by decision-directed estimation. Linear filtering provides a preliminary separation of different waveforms and is followed by a non-linear, final detection algorithm. Estimated motor unit potentials are characterized by a number of parameters. One- and two-dimensional probability density functions describe statistically the timing patterns (point processes) representing the activations of individual motor units. Detection error probability was measured and overall performance of the system tested with synthetic signals. Further, a few clinical applications and results are enclosed. The first chapter presents a physiological model to investigate the relation between geometrical structure and resulting waveform of a motor unit. It shows quantitatively the variation of a given waveform due to certain unstable mechanical and physiological parameters, which affects the performance of the system.