
Contents

Part I

1	Introduction and Applications of Surface EMG	3
1.1	Objectives	3
1.2	Two Simple Examples from Related Fields	4
1.3	Applications of sEMG	5
2	Basic Concepts Concerning Fields and Potential Distributions of Stationary and Moving Point Sources	7
2.1	The Concept of Potential	7
2.2	Single Stationary Point Source	8
2.3	Single Moving Point Source and Single Sensor	10
2.4	Single Moving Point Source and Two Sensors	12
2.5	A Sinusoidal Wave Moving in Space Under Two Sensors	12
2.6	A Moving Dipole Source and Two Sensors.....	14
2.7	Other Moving Sources and Multiple Sensors Aligned with the Movement Direction.....	15
2.8	Grids of Detectors and Two-Dimensional Representations....	18
2.9	The Concept of a Spatial Filter	19
	Suggested Reading	20
3	Generation, Propagation, and Extinction of Single-Fiber and Motor Unit Action Potentials	21
3.1	The Membrane Resting Potential	21
3.2	Generation of the Action Potential	22
3.3	Propagation of the Action Potential	23
3.4	The “End-of-Fiber” Effect	27
3.5	The Motor Unit Action Potential (MUAP).....	29
3.6	The Interferential EMG Signal and the Issue of Electrode Location.....	31
3.7	Muscle Architecture and sEMG: Pinnate Muscles	35
	Suggested Reading	37
4	EMG Imaging: Geometry and Anatomy of the Electrode-Muscle System	39
4.1	The Concept of Sampling and Interpolation of One-Dimensional Signals.....	39

4.2	The Concept of Sampling and Interpolation of Two-Dimensional Signals	40
4.3	Two-Dimensional EMG Detection in Fusiform Muscles.....	40
4.4	EMG Spatial Filtering	44
4.5	The Issue of Interelectrode Distance and Electrode Location.....	45
4.6	Two-Dimensional EMG Detection in Pinnate Muscles.....	46
	Suggested Reading	47
5	Features of the Single-Channel sEMG Signal.....	49
5.1	Interferential EMG Signals	49
5.2	Amplitude Features of EMG Signals: Single-Channel.....	49
5.3	Basic Concepts of Analysis in the Frequency Domain.....	52
5.4	The Concept of the Power Spectrum and the Spectral Features of the Surface Single-Channel EMG Signal	55
	Suggested Reading	59
6	Features of the Two-Dimensional sEMG Signal: EMG Feature Imaging	61
6.1	Amplitude Variables and Their Spatial Distribution	61
6.2	Spectral Variables and Their Spatial Distribution.....	66
6.3	Spectral Variables and Muscle Fiber Conduction Velocity.....	68
	Suggested Reading	68
7	Applications of sEMG in Dynamic Conditions, Ergonomics, Sports, and Obstetrics.....	71
7.1	Why is it Important to Know the Location of the Innervation Zone?.....	71
7.2	Applications in Dynamic Conditions	72
7.3	Applications in Ergonomics	72
7.4	Applications in Exercise and Sports	73
7.5	Applications in Obstetrics.....	77
7.6	Other Applications and Future Perspectives.....	77
	Suggested Reading	78

Part II

Trunk

Sternocleidomastoid	89
Pectoralis Major.....	90
Serratus Anterior	91
Rectus Abdominis: Superior (I)	92
Rectus Abdominis: Middle (II).....	93
Rectus Abdominis: Inferior (III)	94
Upper Trapezius.....	95
Middle Trapezius	96
Lower Trapezius	97
Rhomboid Major.....	98

Rhomboid Minor.....	99
Infraspinatus.....	100
Latissimus Dorsi	101
Erector Spinae	102
Upper Limb	
Posterior Deltoid.....	105
Lateral Deltoid.....	106
Anterior Deltoid.....	107
Long Head of the Triceps	108
Lateral Head of the Triceps.....	109
Short Head of the Biceps Brachii.....	110
Long Head of the Biceps Brachii	111
Palmaris Longus	112
Flexor Carpi Radialis.....	113
Pronator Teres.....	114
Brachioradialis	115
Extensor Carpi Ulnaris	116
Extensor Carpi Radialis.....	117
Abductor Digiti Minimi	118
Flexor Pollicis Brevis.....	119
Abductor Pollicis Brevis.....	120
Lower Limb	
Gluteus Maximus.....	123
Gluteus Medius.....	124
Semitendinosus.....	125
Biceps Femoris	126
Gastrocnemius Medialis.....	127
Gastrocnemius Lateralis	128
Soleus.....	129
Tensor Fasciae Latae.....	130
Vastus Medialis.....	131
Rectus Femoris	132
Vastus Lateralis.....	133
Tibialis Anterior.....	134
Peroneus Longus.....	135
Additional Reading	137
Subject Index	139