

Contents

1	Introduction	1
2	<i>CSB</i>–Physics and Metaphysics.....	5
2.1	Qualitative <i>CSB</i> and Standard Physical Theory	7
2.1.1	Poincaré’s Qualitative Dynamics	7
2.1.2	Poincaré’s Point of View: Phase–Portrait	7
2.1.3	Standard Description of a Physical Theory	9
3	<i>CSB</i>–Structure and Function	11
3.1	Basic Input–Output <i>CSB</i> –System	11
3.2	Example of a ‘Pure <i>CSB</i> –System’: Human Skeletal Muscle	13
3.3	Example of an ‘Applied <i>CSB</i> –System’: Sprint Velocity Curve	20
4	<i>CSB</i>–Biomechanics: Structure and Function of Human Motion	23
4.1	History	23
4.2	Group Dynamics	25
4.3	Hamiltonian Biomechanics	27
4.4	Muscular Mechanics	30
4.4.1	Elements of Muscular Histology	30
4.4.2	Huxley’s Sliding–Filaments Dynamics	32
4.4.3	Hill’s Force–Velocity (Thermo)Dynamics	33
4.4.4	Basic Musculo–Skeletal Dynamics	34
4.5	Stretch Reflex and Motor Servo	36
4.6	Cerebellar Movement Control	39
4.7	Closing the (Bio)Mechanical Circle	45
4.8	Biomechanical Chain	47
4.9	Estimation of Musculo–Skeletal Parameters	49

4.9.1	Measurement of Muscular Input Torques	49
4.9.2	Measurement of Skeleton and Joint Parameters	50
4.9.3	Testing of Model Outputs	50
4.9.4	Further Analysis of Model Outputs	51
4.10	Stochastic Forces	51
5	<i>CSB–System</i>	55
5.1	Linear <i>CSB</i>	55
5.2	Functional <i>CSB</i>	58
5.3	Nonlinear <i>CSB</i>	60
5.4	<i>CSB–Cognition</i>	62
6	<i>CSB–Synergetics: Escape from Chaos</i>	69
6.1	Biomechanical Chaos	69
6.2	Basic Principles of Synergetics	70
6.3	Phase Transitions	72
6.4	Order Parameters	74
6.5	Macroscopic Biomechanics	75
6.6	Control of the Biomechanical Chaos	76
7	<i>CSB–Subsystems: Energy and Information Flows</i>	79
7.1	<i>CSB–Energy Flows</i>	79
7.1.1	The Immediate Energy Source	79
7.1.2	The Principle of Coupled Reactions	79
7.1.3	<i>ATP – PC</i> : The Phosphagen System	80
7.1.4	The Lactic Acid System	80
7.1.5	The Oxygen, or Aerobic, System	81
7.1.6	The Energy Continuum Concept	82
7.2	<i>CSB–Information Flows</i>	83
7.2.1	<i>CSB–Motor Learning</i>	83
7.2.2	<i>CSB–Adaptive Filtration</i>	84
8	<i>Neuro–CSB: Artificial Neural Networks</i>	87
8.1	Introduction	87
8.2	History	88
8.3	Backpropagation of Error	91
8.3.1	Encoding	91
8.3.2	Recall – Test	92
8.4	Hopfield Neural Network	93
8.5	<i>CSB–Neurodynamics: The Cerebellum</i>	97
9	<i>CSB–Intelligence</i>	105
9.1	Human Mind	105
9.2	Human Intelligence	143
9.2.1	Psychometric Definition of Intelligence	145
9.2.2	Correlation and Factor Analysis	149
9.2.3	Cognitive Versus Not–Cognitive Intelligence	173

9.2.4	Intelligence and Cognitive Development	175
9.2.5	Psychophysics.....	179
9.2.6	Human Problem Solving	185
9.2.7	Human Mind	192
9.2.8	The Mind–Body Problem.....	197
9.2.9	Analytical Psychology	209
10	Smart <i>CSB</i>–Agents for Games Modelling	215
10.1	<i>CSB</i> –Agents	215
10.2	Types of <i>CSB</i> –Agents.....	217
10.2.1	Deliberate Agents	217
10.2.2	Reactive Agents	219
10.2.3	Hybrid Agents	220
10.3	<i>CSB</i> –Agents’ Environments.....	221
10.4	<i>CSB</i> –Agents’ Reasoning and Learning	224
10.4.1	Reasoning and Behavior	224
10.4.2	Rational Reasoning	225
11	Psycho–<i>CSB</i>: Mental Concentration in Sport	229
11.1	Introduction	229
11.2	Concentration in Sport: Experiences of Top Athletes	231
11.3	Concentration Exercises for Training and Competition	232
11.4	Inspiration and Enthusiasm, Discipline and Progress	232
12	Tennis Champion of the Future	235
12.1	Introduction	235
12.2	Contemporary Tennis Science	237
12.2.1	Tennis Muscles	237
12.2.2	Tennis Anatomy	242
12.2.3	Tennis Energetics	243
12.2.4	Tennis Biomechanics	249
12.2.5	Motor Control in Tennis	255
12.2.6	Tennis Psychology	258
12.3	Tennis Science of the Future	266
12.3.1	High Performance in Tennis	266
12.3.2	Athleticism in Tennis	267
12.3.3	<i>Muscular Slingshots</i>	272
12.3.4	The Biomechanics of Whip–Like Movements	281
12.3.5	<i>Superior</i> Tennis Weapons	282
12.3.6	Mental Training in Tennis	285
12.3.7	Tennis Chess	289
12.3.8	The Tennis Champion of the Future	291
12.4	A Fuzzy–Logic Tennis Simulator	293
References	299
Index	319