

# Table of contents

<b>Introduction</b>	<b>9</b>
<b>I Physics "pour tout Le Monde"</b>	
by <b>D. Larousserie and P. Lepidi, journalistes au Monde</b>	<b>11</b>
1 Why do we swim faster underwater? . . . . .	11
2 Why don't we make longer rowing oars? . . . . .	14
3 Why do balls zigzag? . . . . .	17
4 Why do jumpers have to rotate their body around the bar? . . . . .	20
5 Why the poles are not longer? . . . . .	23
6 Why don't we jump with our eyes wide - shut? . . . . .	25
7 Why do arrows warp? . . . . .	28
8 Why does the ball spin before ending up in the basket? . . . . .	31
9 Why do we never forget how to ride a bike? . . . . .	34
10 Why do sprinters have swollen calves? . . . . .	37
11 Why don't we run barefoot? . . . . .	40
12 Why do race walkers flail their arms? . . . . .	43
<b>II Waves and fluids</b>	<b>47</b>
1 Rowing, Sailing and Swimming by M. Fermigier and M. Rabaud . . . . .	47
2 Some fundamental principles of the physics of sailing by R. Garrett . . . . .	53
3 Topics on the Physics of Sailing by R. Garrett . . . . .	60
4 Fluid Structure Interaction of Yacht Sails in the Unsteady Regime by B. Augier, P. Bot, F. Hauville <i>et al.</i> . . . . .	66
5 Contribution to the study of propulsion in front crawl swimmer by J.-M. Hespel, M. Sidney, F. Huot-Marchand <i>et al.</i> . . . . .	79
6 Effects of fluid stratification on swimming, rowing and paddling by L.R.M. Maas . . . . .	88

7	Wave drag on the swimmer by A. Benusiglio and C. Clanet . . . . .	98
8	Numerical Research of Unsteady Phenomena at Human Undulatory Swimming by S. Pacholak and C. Brücker . . . . .	105
9	Steady State Analysis of Rowing Oars and Blade Design by H. Nørstrud, E.A. Meese . . . . .	116
10	Towards a Better Knowledge of the Flow Around Rowing Blade by A. Leroyer, S. Barré, J. Wackers <i>et al.</i> . . . . .	124
11	Wind-Wave Interactions in Enclosed Basins: the Impact on the Sport of Rowing by A. Pezzoli, A. Baldacci, A. Cama <i>et al.</i> . . . . .	139
12	GMRS, a Framework for the Dynamic Simulation of the Boat-Oars- Rower(s) systems by F. Rongère . . . . .	152
<b>III Aerodynamics</b>		<b>165</b>
1	Introduction: Aerodynamics in Sports by C. Clanet . . . . .	165
2	The aerodynamics of the beautiful game by J.W.M. Bush . . . . .	171
3	Bending a free kick by G. Dupeux, A. Le Goff, D. Quéré <i>et al.</i> . . . . .	193
4	Knuckleballs by B. Darbois Texier, C. Cohen and D. Quéré . . . . .	199
5	A method for calculating football aerodynamic profiles by S. Choppin . . . . .	213
6	What New Technologies Are Teaching Us About the Game of Baseball by A.M. Nathan . . . . .	218
7	Slow down before you hit the ball or use topspin for a higher accuracy in tennis by S. Hochstein, R. Blickhan and H. Wagner . . . . .	230
8	The influence of turbulence in ball games by M. Obligado, M. Bourgoïn . . . . .	241
9	Badminton shuttlecock by C. Cohen, B. Darbois Texier, D. Quéré <i>et al.</i> . . . . .	252
10	Size of Sports Fields by B. Darbois Texier, C. Cohen, D. Quéré <i>et al.</i> . . . . .	259
11	Physics of Ski Jumping by W. Müller . . . . .	271
12	Ski jump Flight by R. Carmigniani, X. Cao, S. Savourey <i>et al.</i> . . . . .	286

13	Aerodynamics of jump in downhill ski racing by G. Gibertini, G. Andreoni, M. Fusca <i>et al.</i> . . . . .	302
14	Numerical investigation of the discus flight by S. Pacholak . . . . .	314
<b>IV Elasticity</b>		<b>321</b>
1	Introduction: Elasticity in the physics of sports by J. Hoepffner . . . . .	321
2	High jump and pole vault: a classical case of tunneling? by A. Eddi . . . . .	334
3	Models for an alternative pole vault by J. Hoepffner . . . . .	345
4	Energy transformations in the pole vault by N.P. Linthorne . . . . .	358
5	Fosbury-flop: What Biomechanics can tell the coach? by G. Laffaye . . . . .	366
6	The Physics of Baseball Bat Performance Measurements by L. Smith . . . . .	372
7	The Toe Poke by C. Cohen, B. Darbois Texier, D. Quéré <i>et al.</i> . . . . .	383
8	Slacklining: dynamics of a fall and strategies towards equilibrium by E. Reyssat, A.-L. Biance . . . . .	394
<b>V Friction</b>		<b>407</b>
1	Friction: an introduction, with emphasis on some implications in winter sports by L. Bocquet . . . . .	407
2	Experiments on the drag reducing properties of superhydrophobic surfaces by B.R.K. Gruncell, N.D. Sandham, M.P. Prince <i>et al.</i> . . . . .	427
3	The physics if ice hockey: skating, the slap shot and body checks by A. Haché . . . . .	439
4	Physics of Elastic Spheres Skipping on Water by J. Belden, M.A. Jandron and T.T. Truscott . . . . .	447
5	Ball-hole interaction in basketball and golf by K. Piroird, D. Quéré and C. Clanet . . . . .	459
6	Collision, deformation and bounce of a squash ball by C. Cohen, B. Darbois-Textier and P. Brunet . . . . .	471
<b>VI Statistical Physics</b>		<b>481</b>
1	Introduction by M. Tolan . . . . .	481

2	Professional Football and Bessel-Functions: A Statistical Analysis by M. Tolan, M. Paulus, R. Fendt <i>et al.</i> . . . . .	484
3	Do the new rules of volleyball enhance tension? by F. Gallaire, M. Choroszynski and M. Van Den Driessche . . . . .	492
4	Statistics, dynamics and football by R.S. Mendes and L.C. Malacarne . . . . .	505
5	A network theory analysis of football strategies by J. López Peña and H. Touchette . . . . .	517
<b>VII Human motion</b>		<b>529</b>
1	Introduction: Human movement science by G. Laffaye, N. Benguigui and M.-A. Choukou . . . . .	529
2	Biological and technological movement by A.E. Minetti . . . . .	543
3	Modeling human body as spring-mass system to assess athletic activities by G. Laffaye and M.A. Choukou . . . . .	556
4	Contribution of Physics to Athletic Monitoring by M.A. Choukou and G. Laffaye . . . . .	561
5	A 2D adaptive human walking model by P. Pécol and A. Alaoui . . . . .	565
6	Identification of kinetic and temporal factors related to snatch lift by P. Campillo and J.-P. Micallef . . . . .	577
7	Muscle Architecture Alterations And Force Production by N. Babault and G. Lattier . . . . .	587
8	Using constraints to estimate sports movement by F. Colloud, V. Fohanno and P. Lacouture . . . . .	597
9	Using aerial movement simulation to teach mechanics theory by A. Decatoire . . . . .	608
10	Complexity as an Index of Postural Control during Multi-joint Move- ments by C. Hansen, Q. Wei, J.-S. Shieh <i>et al.</i> . . . . .	615
11	Once you have learnt how to ski, you'll never forget by D. Nourrit-Lucas, G. Zelic and D. Delignières . . . . .	622