BIOMEKANIKA OLAHRAGA
(SPORT BIOMECHANICS)

DEFINISI

1. Biomechanics uses the scientific methods of mechanics to study the effects of various forces on the sports performer. It is concerned, in particular, with the human neuromusculoskeletal system. It is also considers aspects of the behaviour of sports implements, footwear and surfaces where these affect performance or injury (Bartlett,1997)

2. Biomechanics is considered to be that aspect of the science concerned with the basic laws governing the effect forces have upon the state of rest or motion of animals or humans (Luttgens, Deutsch, Hamilton, 1992)

3. Biomechanics may be defined as that area of study wherein the knowledge and methods of mechanics are applied to the structure and function of living human system (Kreighbaum, Barthels, 1981)

4. Biomechanics is the science concerned with the internal and external forces acting on a human body and the effects produced by these forces (Hay, 1993)

5. Biomechanics involves the use of the tools of mechanics, the branch of physics that analyzes the actions of forces, in the study of anatomical and functional aspects of living organisms (Hall, 1995)

6. Biomechanics is the application of the laws and principles of mechanics to living organisms (Carr, 1997)

KINESIOLOGI

- Adapted Physical Education
- Biomechanics
- Exercise physiology
- Motor Behavior
- Pedagogy
- Sport art
- Sport history
- Sport philosophy
- Sport psychology
- Sport sociology

Subdisiplin Kinesiologi

Sumber : Hall (1995, hl 6)

SPORT MEDICINE

Scientific aspects	Clinical aspects
Biomechanics	Athletic medicine
Exercise physiology	Athletic training
Motor behavior	Cardiac rehabilitation
Sports nutrition	Physical therapy
Sports psychology	Other specialities

FUNGSI

Biomekanika berguna bagi para pelatih, atlet, guru penjas, dan penggemar olahraga
Bidang studi ini menjelaskan bagaimana pengetahuan tentang mekanika olahraga membantu menciptakan performa yang lebih baik

Pelatih : membantu menjadi seorang pelatih yang lebih baik
Atlet : menemukan bahwa informasi dalam biomekanika membantu memperbaiki penampilannya
Penggemar : membantu menjadi pengamat olahraga yang kritis

Ketika mempelajari Biomekanika olahraga, tidak terkonsentrasi hanya pada berbagai cabang olahraga – seperti bola voli, tenis, badminton dsb atau beberapa keterampilan khusus – passing, servis, atau spike. Malahan Biomekanika olahraga menjelaskan bagaimana dan mengapa pemahaman dasar prinsip-prinsip mekanika membantu menciptakan peningkatan penampilan

Jika pelatih sedang dalam proses latihan, maka akan mampu mengamati penampilan atletnya & berkata pada dirinya sendiri :
" beberapa aksi (gerakan) yang ditampilkan atlet cukup baik, tetapi masih terdapat beberapa aksi yang tidak efisien dan perlu perbaikan"

What I know of Biomechanics tells me that they are wrong, and I know
What kind of movements should replace them.

Ketika dibuat koreksi atau perbaikan, maka atlet akan mempunyai teknik yang lebih efisien dan penampilannya semakin lebih baik

Para ilmuwan yang berurusan dengan mekanika mempelajari efek dari berbagai gaya (seperti gravitasi, gesekan, tahanan udara) terhadap benda atau manusia. Pengetahuan mekanika digunakan untuk membantu mendesain benda-benda Dalam kehidupan sehari-hari seperti : gedung-gedung, jembatan, kendaraan, dan pesawat terbang. Selain itu pula, dipelajari efek gaya terhadap manusia dan Sebaliknya, efek gaya yang diterapkan oleh manusia

Jelas sekali bahwa gravitasi, gesekan, dan tahanan udara berpengaruh baik terhadap aktivitas olahraga maupun di luar olahraga.

Seorang pelompat tinggi berlomba melawan gravitasi sama seperti seseorang yang sedang menaiki tangga, atau kapal udara yang akan takeoff.

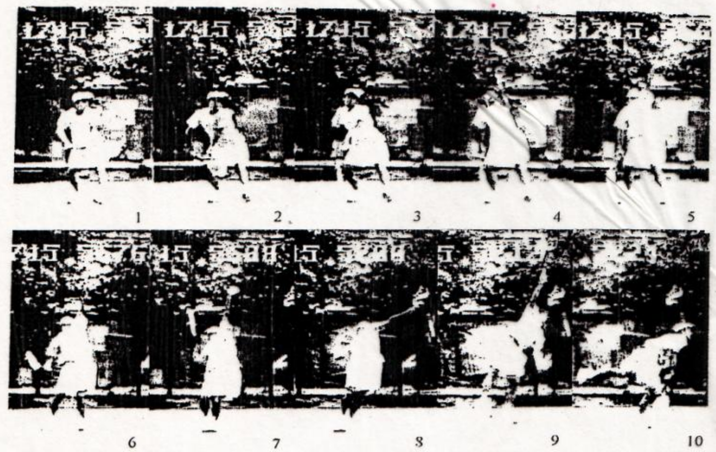
Begitupun tahanan udara dan gesekan menghambat para pembalap sepeda.

Hal ini menunjukkan bahwa prinsip-prinsip mekanika yang sama digunakan dalam kehidupan sehari-hari dapat diterapkan pada aktivitas olahraga

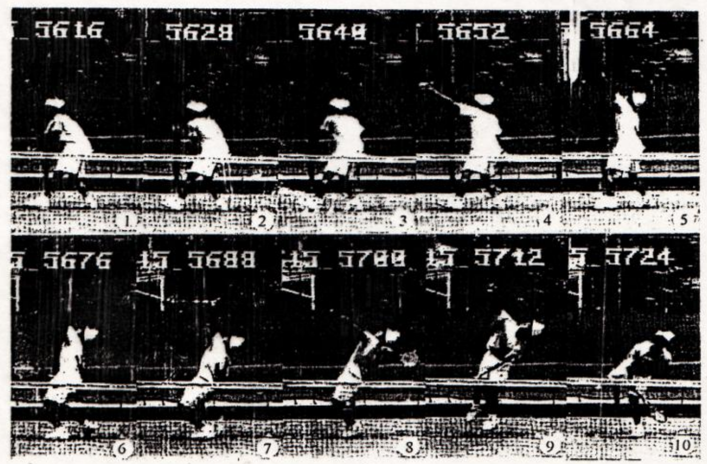
PRINSIP-PRINSIP MEKANIKA

Dalam olahraga, prinsip-prinsip mekanika tidak lain dari pada prinsip dasar yang mengatur aksi atlet
Contoh : Jika pelatih dan atlet memahami karakteristik gaya gravitasi bumi, maka mereka mengetahui apa yang harus dilakukan mengatasi efek gaya ini, dan sebaliknya aksi apa yang harus ditampilkan dengan memanfaatkan gaya ini. Seorang peloncat indah menyadari bahwa gravitasi bekerja tegak lurus dengan permukaan bumi, maka harus memahami tentang lintasan bagaimana yang memberikan jalur melayang optimalnya.

Begitu pula para pegulat menggunakan gravitasi ketika lawannya sudah berada pada posisi tidak seimbang. Sebaliknya jika tidak mempertahankan kestabilannya, maka gravitasi berbalik menjadi teman lawan dan akan memutarnya ke samping.



Subject A. (34 m/sec). Side view of the tennis serve. Time between picture is 0.2 second:



Subject A. Front vie:.

Fig 5c. The performa .ce of tennis serve of each subject

Sequence form servis tenis front view – side view

Lokasi : Yamanashi University Japan

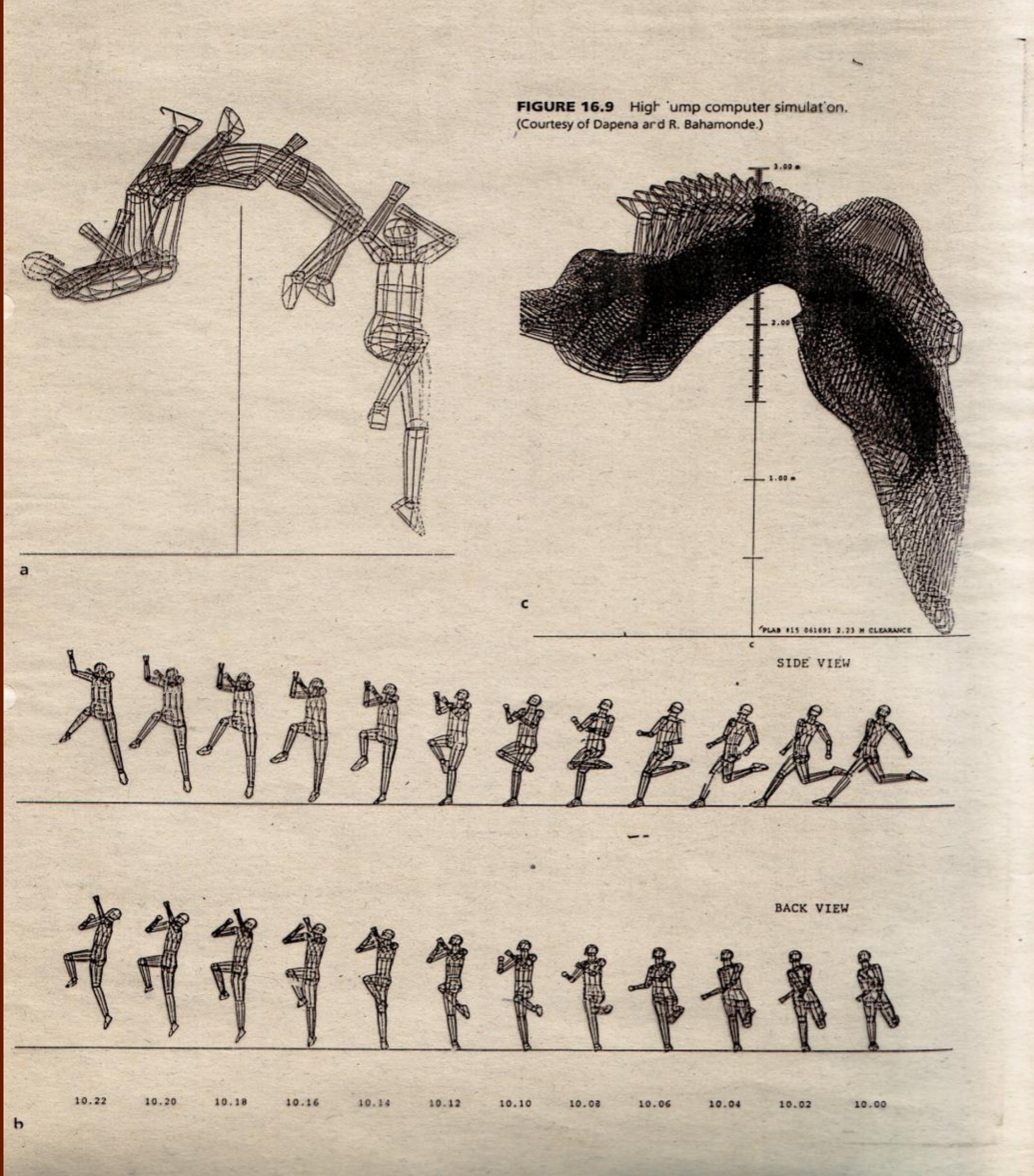


FIGURE 16.9 High jump computer simulation.
(Courtesy of Dapena and R. Bahamonde.)

High jump computer simulation

Figure 1

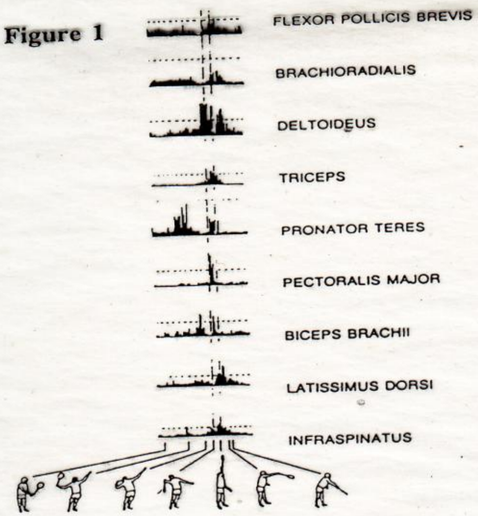


Figure 2

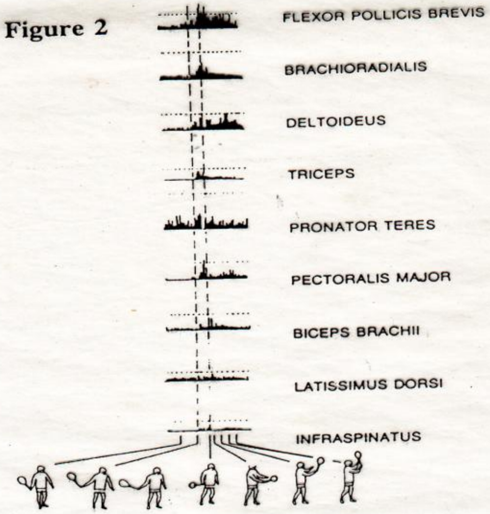


Figure 3

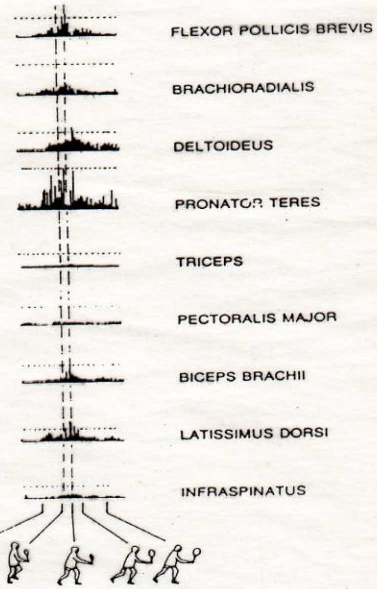
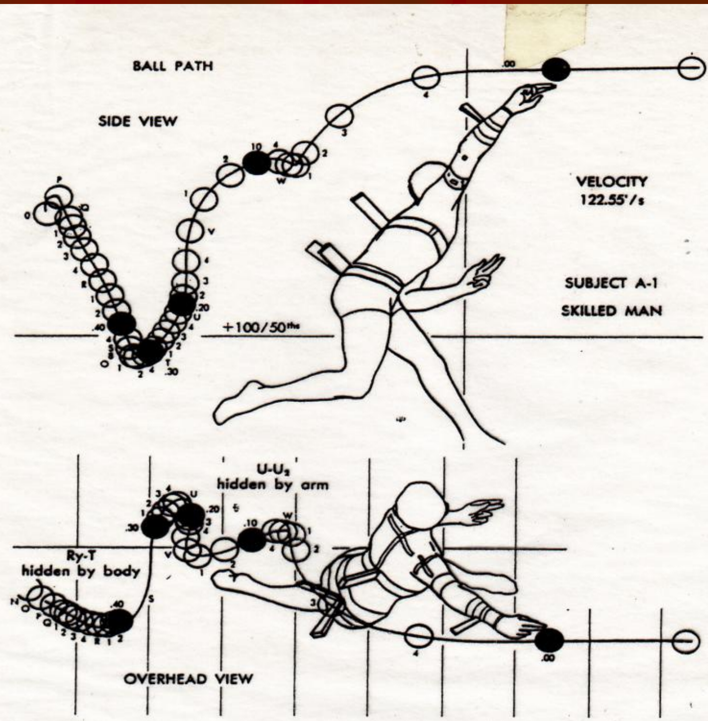


Figure 1 — **Electromyographic recording of the service of player C.**

Figure 2 — **Electromyographic recording of the forehand of player C.**

Figure 3 — **Electromyographic recording of the volley of player C.**

Aktivasi otot selama servis, drive, dan voli tenis



path of ball. Circles represent equal time intervals. Note the fins to track rotations of body segments. Fins are also useful devices when only one camera can be used.
(From Atwater, A. E. 1970. Movement characteristics of the overarm throw, Ph.D. dissertation, University of Wisconsin.)

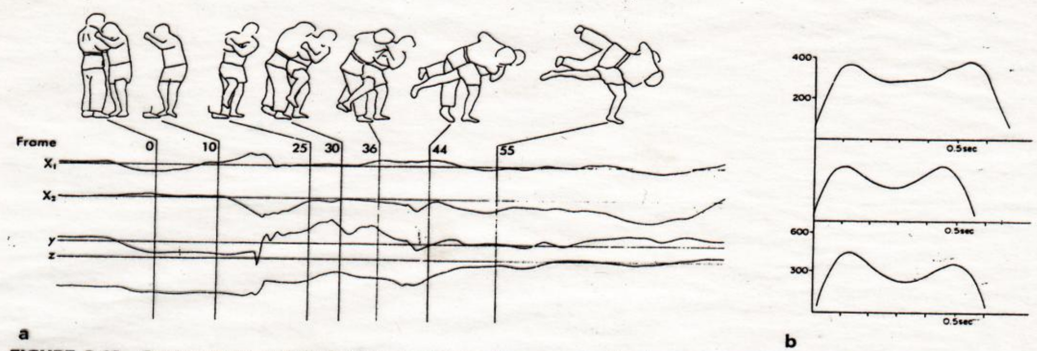


FIGURE 8.12 Contourogram and three-dimensional force-time histories of judo throw (*a*), and walking at different speeds (*b*). Note how much easier it is to evaluate the kinetics of a cyclic and mostly planar movement than that of a three-dimensional movement, such as a judo throw.

A : Disp
83
96

時間	右手首:[m]	右肘:[m]	右肩:[m]	ラケット:[m]	右手首:[m]	右肘:[m]	右肩:[m]	ラケット:[m]	右手首:[m]変	右肘:[m]	右肩:[m]	ラケット:[m]	右手首:[m	右肘:[m]	右肩:[m]	ラケット:[m]変位:合成
0	1.206	0.998	0.862	1.168	0.383	0.249	0.265	0.912	0.918	1.077	1.289	0.965	1.563	1.489	1.573	1.768
0.0167	1.173	0.98	0.85	1.148	0.361	0.239	0.26	0.894	0.903	1.076	1.289	0.922	1.524	1.475	1.566	1.722
0.0333	1.144	0.959	0.837	1.129	0.338	0.228	0.252	0.873	0.889	1.074	1.288	0.876	1.488	1.458	1.557	1.675
0.05	1.117	0.933	0.823	1.11	0.313	0.216	0.244	0.848	0.877	1.069	1.287	0.827	1.455	1.436	1.547	1.624
0.0667	1.089	0.906	0.81	1.089	0.287	0.2	0.235	0.82	0.864	1.065	1.284	0.777	1.42	1.413	1.536	1.569
0.0833	1.058	0.88	0.798	1.065	0.261	0.183	0.226	0.788	0.847	1.062	1.28	0.727	1.38	1.392	1.525	1.512
0.1	1.02	0.856	0.783	1.039	0.237	0.165	0.216	0.755	0.825	1.059	1.276	0.679	1.333	1.372	1.513	1.454
0.1167	0.975	0.833	0.764	1.014	0.21	0.148	0.205	0.72	0.803	1.054	1.274	0.636	1.281	1.352	1.5	1.397
0.1333	0.927	0.81	0.74	0.989	0.181	0.133	0.195	0.683	0.786	1.046	1.274	0.598	1.229	1.33	1.486	1.342
0.15	0.884	0.787	0.714	0.965	0.152	0.119	0.184	0.646	0.775	1.036	1.274	0.565	1.186	1.307	1.473	1.292
0.1667	0.85	0.767	0.694	0.942	0.125	0.104	0.174	0.611	0.768	1.027	1.274	0.538	1.153	1.286	1.461	1.245
0.1833	0.821	0.747	0.68	0.92	0.1	0.089	0.165	0.575	0.762	1.02	1.274	0.513	1.125	1.268	1.453	1.201
0.2	0.793	0.721	0.669	0.899	0.077	0.075	0.16	0.539	0.756	1.017	1.276	0.492	1.099	1.25	1.449	1.158
0.2167	0.765	0.688	0.657	0.879	0.055	0.064	0.157	0.504	0.751	1.017	1.278	0.474	1.074	1.23	1.446	1.119
0.2333	0.739	0.655	0.641	0.861	0.037	0.056	0.155	0.47	0.748	1.016	1.281	0.46	1.052	1.211	1.441	1.084
0.25	0.712	0.629	0.617	0.845	0.021	0.051	0.152	0.438	0.747	1.015	1.286	0.447	1.033	1.195	1.434	1.052
0.2667	0.683	0.604	0.586	0.831	0.008	0.049	0.151	0.408	0.75	1.012	1.294	0.435	1.015	1.18	1.429	1.023
0.2833	0.65	0.57	0.557	0.816	-0.003	0.048	0.15	0.379	0.758	1.01	1.302	0.423	0.999	1.162	1.425	0.994
0.3	0.614	0.524	0.534	0.797	-0.011	0.046	0.151	0.351	0.767	1.011	1.309	0.41	0.983	1.141	1.422	0.962
0.3167	0.578	0.48	0.518	0.77	-0.018	0.044	0.151	0.322	0.774	1.018	1.314	0.392	0.967	1.127	1.42	0.922
0.3333	0.543	0.449	0.504	0.737	-0.024	0.041	0.151	0.29	0.778	1.029	1,317	0.367	0.95	1.124	1.418	0.874
0.35	0.512	0.432	0.49	0.702	-0.028	0.039	0.151	0.26	0.779	1.039	1.32	0.34	0.933	1.126	1.416	0.822
0.3667	0.484	0.423	0.475	0.67	-0.03	0.038	0.152	0.233	0.777	1.043	1.323	0.316	0.917	1.126	1.414	0.777
0.3833	0.461	0.414	0.464	0.645	-0.03	0.039	0.153	0.211	0.775	1.043	1.325	0.296	0.903	1.123	1.412	0.74
0.4	0.441	0.405	0.458	0.621	-0.029	0.039	0.153	0.193	0.775	1.043	1.325	0.278	0.893	1.119	1.41	-0.708
0.4167	0.419	0.395	0.451	0.592	-0.027	0.039	0.149	0.177	0.778	1.043	1.324	0.261	0.884	1.116	1.407	0.671
0.4333	0.39	0.383	0.441	0.557	-0.023	0.042	0.147	0.164	0.781	1.043	1.323	0.246	0.874	1.112	1.402	0.631
0.45	0.356	0.37	0.427	0.526	-0.018	0.047	0.147	0.155	0.786	1.045	1.322	0.234	0.864	1.109	1.397	0.596
0.4667	0.322	0.356	0.414	0.505	-0.013	0.054	0.15	0.148	0.793	1.045	1.322	0.225	0.857	1.106	1.393	0.573
0.4833	0.296	0.342	0.402	0.492	-0.008	0.06	0.153	0.144	0.798	1.044	1.321	0.218	0.852	1.1	1.389	0.558
0.5	0.281	0.329	0.395	0.481	-0.002	0.068	0.153	0.143	0.801	1.041	1.319	0.212	0.849	1.094	1.386	0.545
0.5167	0.273	0.318	0.391	0.467	0.005	0.074	0.152	0.145	0.802	1.037	1.317	0.207	0.847	1.088	1.382	0.531
0.5333	0.266	0.31	0.388	0.454	0.013	0.078	0.152	0.148	0.802	1.035	1.314	0.202	0.845	1.084	1.378	0.519
0.55	0.255	0.306	0.386	0.446	0.026	0.08	0.153	0.151	0.801	1.035	1.311	0.2	0.841	1.083	1.375	0.511
0.5667	0.245	0.306	0.387	0.443	0.039	0.084	0.154	0.156	0.798	1.037	1.309	0.2	0.836	1.085	1.373	0.511
0.5833	0.241	0.309	0.39	0.45	0.052	0.094	0.154	0.163	0.796	1.039	1.308	0.202	0.833	1.088	1.373	0.52
0.6	0.245	0.313	0.396	0.469	0.061	0.108	0.154	0.17	0.795	1.04	1.308	0.206	0.835	1.092	1.376	0.54
0.6167	0.254	0.321	0.401	0.494	0.071	0.122	0.156	0.176	0.795	1.042	1.309	0.211	0.838	1.097	1.378	0.566
0.6333	0.262	0.331	0.407	0.518	0.085	0.133	0.16	0.182	0.795	1.044	1.31	0.215	0.841	1.103	1.381	0.591
0.65	0.27	0.342	0.413	0.541	0.098	0.142	0.165	0.186	0.792	1.046	1.31	0.216	0.843	1.109	1.384	0.612
0.6667	0.281	0.354	0.42	0.561	0.113	0.149	0.171	0.19	0.787	1.046	1.311	0.214	0.844	1.114	1.387	0.63
0.6833	0.297	0.37	0.428	0.584	0.126	0.155	0.177	0.193	0.78	1.044	1.311	0.211	0.845	1.119	1.39	0.65
0.7	0.317	0.392	0.436	0.609	0.137	0.165	0.184	0.194	0.774	1.04	1.31	0.207	0.848	1.124	1.393	0.672
0.7167	0.335	0.415	0.441	0.632	0.148	0.178	0.19	0.194	0.77	1.034	1.308	0.202	0.853	1.129	1.394	0.692
0.7333	0.352	0.435	0.447	0.652	0.157	0.189	0.197	0.193	0.767	1.03	1.305	0.195	0.859	1.134	1.394	0.708
0.75	0.375	0.448	0.454	0.671	0.167	0.198	0.203	0.191	0.765	1.028	1.303	0.189	0.869	1.139	1.395	0.723
0.7667	0.403	0.457	0.462	0.694	0.177	0.206	0.211	0.189	0.764	1.027	1.3	0.184	0.883	1.143	1.396	0.743
0.7833	0.434	0.464	0.47	0.724	0.186	0.213	0.221	0.188	0.765	1.026	1.298	0.183	0.899	1.147	1.398	0.77
0.8	0.462	0.473	0.478	0.764	0.194	0.22	0.232	0.187	0.765	1.027	1.298	0.187	0.915	1.152	1.402	0.808
0.8167	0.49	0.489	0.488	0.814	0.205	0.227	0.244	0.186	0.763	1.029	1.298	0.199	0.93	1.161	1.408	0.859
0.8333	0.522	0.513	0.496	0.875	0.216	0.235	0.256	0.188	0.761	1.028	1.3	0.22	0.949	1.173	1.415	0.922
0.85	0.559	0.538	0.504	0.942	0.228	0.244	0.268	0.192	0.762	1.024	1.301	0.245	0.973	1.182	1.42	0.993
0.8667	0.597	0.556	0.51	1.009	0.238	0.254	0.281	0.198	0.767	1.018	1.299	0.274	1.001	1.187	1.424	1.065
0.8833	0.632	0.565	0.517	1.075	0.246	0.266	0.297	0.203	0.768	1.012	1.296	0.311	1.026	1.189	1.427	1.137
0.9	0.665	0.566	0.525	1.139	0.256	0.28	0.311	0.208	0.763	1.008	1.291	0.357	1.045	1.189	1.428	1.212
0.9167	0.693	0.565	0.533	1.202	0.27	0.294	0.325	0.214	0.759	1.004	1.285	0.414	1.063	1.189	1.429	1.29
0.9333	0.719	0.561	0.541	1.261	0.283	0.309	0.339	0.222	0.764	0.998	1.28	0.48	1.087	1.186	1.431	1.368
0.95	0.751	0.557	0.548	1.313	0.298	0.326	0.357	0.233	0.779	0.991	1.276	0.55	1.123	1.183	1.434	1.444
0.9667	0.783	0.556	0.554	1.36	0.313	0.344	0.376	0.246	0.798	0.984	1.27	0.623	1.162	1.181	1.436	1.517
0.9833	0.795	0.558	0.559	1.399	0.328	0.36	0.397	0.262	0.817	0.977	1.265	0.701	1.187	1.182	1.439	1.588
1	0.789	0.564	0.564	1.428	0.344	0.374	0.416	0.279	0.832	0.972	1.261	0.785	1.198	1.184	1.443	1.655
1.0167	0.793	0.571	0.571	1.445	0.362	0.39	0.434	0.295	0.84	0.964	1.257	0.871	1.211	1.187	1.447	1.715
1.0333	0.817	0.579	0.576	1.45	0.38	0.41	0.449	0.311	0.842	0.953	1.249	0.956	1.234	1.189	1.447	1.767
1.05	0.843	0.587	0.58	1.449	0.398	0.431	0.464	0.326	0.846	0.94	1.239	1.036	1.259	1.19	1.445	1.813
1.0667	0.858	0.594	0.582	1.441	0.409	0.453	0.482	0.342	0.86	0.925	1.227	1.114	1.282	1.19	1.441	1.855
1.0833	0.863	0.601	0.584	1.422	0.421	0.475	0.502	0.359	0.883	0.913	1.214	1.191	1.304	1.192	1.438	1.892
1.1	0.863	0.606	0.585	1.391	0.434	0.5	0.523	0.376	0.907	0.905	1.202	1.267	1.325	1.199	1.436	1.921
1.1167	0.861	0.61	0.588	1.348	0.45	0.523	0.543	0.394	0.928	0.901	1.191	1.34	1.344	1.208	1.435	1.944
1.1333	0.857	0.615	0.591	1.294	0.464	0.542	0.56	0.415	0.948	0.896	1.179	1.41	1.36	1.214	1.434	1.961
1.15	0.846	0.621	0.596	1.23	0.477	0.555	0.575	0.436	0.969	0.888	1.169	1.476	1.373	1.218	1.433	1.974
1.1667	0.832	0.628	0.6	1.157	0.488	0.566	0.589	0.459	0.993	0.878	1.16	1.538	1.385	1.219	1.433	1.982
1.1833	0.809	0.634	0.602	1.072	0.498	0.577	0.604	0.487	1.021	0.871	1.154	1.592	1.396	1.222	1.435	1.985
1.2	0.785	0.637	0.604	0.975	0.506	0.584	0.622	0.52	1.048	0.869	1.15	1.638	1.405	1.226	1.44	1.981
1.2167	0.764	0.641	0.605	0.867	0.513	0.59	0.64	0.561	1.072	0.87	1.15	1.673	1.413	1.231	1.449	1.972
1.2333	0.746	0.647	0.608	0.747	0.519	0.596	0.658	0.608	1.096	0.875	1.152	1.693	1.424	1.24	1.459	1.954
1.25	0.725	0.653	0.61	0.618	0.526	0.601	0.67	0.659	1.122	0.884	1.155	1.693	1.436	1.253	1.468	1.927
1.2667	0.694	0.658	0.612	0.491	0.535	0.603	0.681	0.714	1.149	0.898	1.16	1.671	1.446	1.266	1.478	1.889
1.2833	0.657	0.661	0.613	0.37	0.543	0.6	0.692	0.765	1.178	0.919	1.169	1.626	1.455	1.281	1.49	1.841
1.3	0.621	0.664	0.614	0.261	0.552	0.593	0.703	0.813	1.208	0.948	1.184	1.561	1.467	1.301	1.508	1.786
1.3167	0.589	0.666	0.619	0.173	0.564	0.586	0.717	0.861	1.24	0.988	1.207	1.478	1.485	1.329	1.535	1.726
1.3333	0.565	0.67	0.628	0.112	0.579	0.581	0.736	0.913	1.271	1.043	1.241	1.372	1.507	1.37	1.574	1.659
1.35	0.549	0.679	0.644	0.089	0.598	0.581	0.761	0.954	1.302	1.115	1.286	1.241	1.535	1.43	1.627	1.575
1.3667	0.537	0.7	0.669	0.11	0.618	0.586	0.79	0.961	1.335	1.201	1.338	1.1	1.566	1.509	1.692	1.472
1.3833	0.534	0.73	0.699	0.182	0.639	0.598	0.818	0.92	1.371	1.3	1.39	0.977	1.604	1.607	1.758	1.364
1.4	0.547	0.765	0.731	0.304	0.657	0.627	0.845	0.837	1.418	1.408	1.435	0.902	1.656	1.721	1.819	1.287
1.4167	0.579	0.802	0.758	0.468	0.677	0.681	0.873	0.734	1.483	1.519	1.476	0.901	1.73	1.848	1.875	1.279
1.4333	0.623	0.839	0.778	0.645	0.706	0.763	0.911	0.629	1.575	1.62	1.515	0.987	1.835	1.979	1.931	1.36
1.45	0.679	0.873	0.79	0.791	0.758	0.866	0.96	0.546	1.691	1.698	1.549	1.158	1.974	2.099	1.987	1.521
1.4667	0.752	0.903	0.796	0.872	0.844	0.973	1.019	0.51	1.819	1.75	1.575	1.41	2.143	2.199	2.039	1.747
1.4833	0.842	0.928	0.797	0.893	0.967	1.071	1.08	0.565	1.93	1.777	1.589	1.734	2.32	2.274	2.081	2.046
1.5	0.936	0.943	0.793	0.902	1.111	1.153	1.138	0.759	1.995	1.782	1.591	2.08	2.472	2.324	2.11	2.411
1.5167	1.013	0.949	0.785	0.96	1.253	1.222	1.192	1.088	2.004	1.772	1.586	2.334	2.576	2.354	2.129	2.776
1.5333	1.064	0.947	0.776	1.072	1.379	1.287	1.225	1.472	1.965	1.748	1.577	2.387	2.631	2.37	2.143	3.043
1.55	1.095	0.944	0.771	1.217	1.484	1.349	1.264	1.803	1.892	1.71	1.564	[illegible].219	2.648	2.376	2.154	3.152
1.5667	1.118	0.945	0.772	1.331	1.569	1.405	1.303	2.019	1.795	1.659	1.542	[illegible]	2.339	2.372	2.162	3.115
1.5833	1.14	0.953	0.777	1.383	1.634	1.45	1.339	2.112	1.677	1.595	1.514	1.528	2.609	2.359	2.166	2.981
1.6	1.157	0.966	0.783	1.374	1.677	1.485	1.375	2.111	1.54	1.522	1.483	1.179	2.56	2.337	2.169	2.802
1.6167	1.164	0.976	0.786	1.322	1.69	1.511	1.409	2.055	1.392	1.443	1.452	0.883	2.49	2.308	2.171	2.612
1.6333	1.157	0.978	0.787	1.244	1.697	1.529	1.44	1.973	1.243	1.361	1.42	0.642	2.405	2.27	2.171	2.43
1.65	1.135	0.974	0.788	1.148	1.679	1.536	1.471	1.881	1.1	1.278	1.385	0.45	2.309	2.225	2.17	2.256
1.6667	1.101	0.969	0.791	1.032	1.647	1.535	1.503	1.784	0.972	1.198	1.349	0.304	2.209	2.177	2.17	2.089
1.6833	1.055	0.963	0.797	0.898	1.609	1.531	1.532	1.687	0.866	1.126	1.313	0.201	2.112	2.131	2.17	1.926
1.7	1.002	0.953	0.809	0.757	1.572	1.526	1.555	1.594	0.786	1.066	1.28	0.139	2.024	2.092	2.17	1.774
1.7167	0.947	0.939	0.82	0.623	1.539	1.52	1.574	1.508	0.731	1.018	1.25	0.118	1.95	2.057	2.171	1.639
1.7333	0.896	0.919	0.83	0.497	1.512	1.517	1.592	1.436	0.693	0.977	1.225	0.133	1.89	2.025	2.174	1.53
1.75	0.851	0.896	0.837	0.382	1.49	1.519	1.611	1.387	0.667	0.939	1.205	0.177	1.841	1.999	2.179	1.455
1.7667	0.809	0.871	0.839	0.274	1.471	1.525	1.631	1.36	0.646	0.903	1.188	0.237	1.798	1.975	2.186	1.407

Data kuantitatif 3D

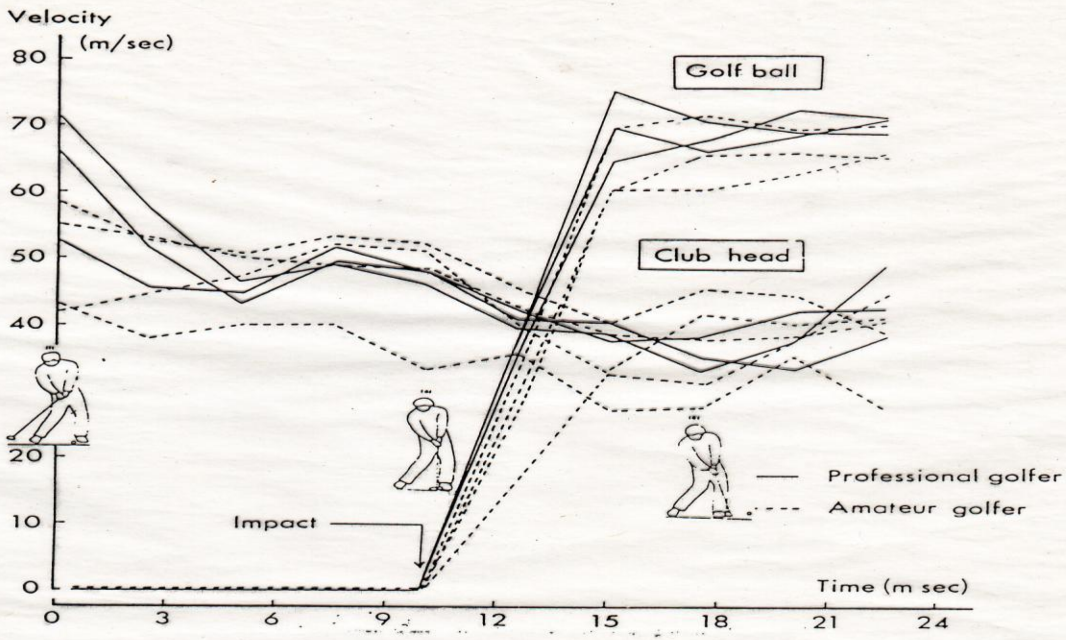


Figure 1 — Changes in velocity of the club head and golf ball around the moment of impact.

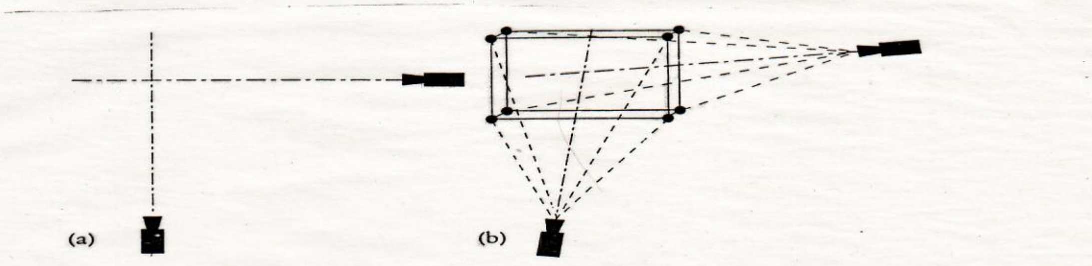


Figure 5.12 Three-dimensional camera alignments: (a) with perpendicularly intersecting optical axes; (b) DLT camera set-up – note that the rays from the calibration spheres are unambiguous for both cameras (for clarity only the rays from all the upper or lower spheres are traced to one or other camera).

Data kinematika dan setting kamera

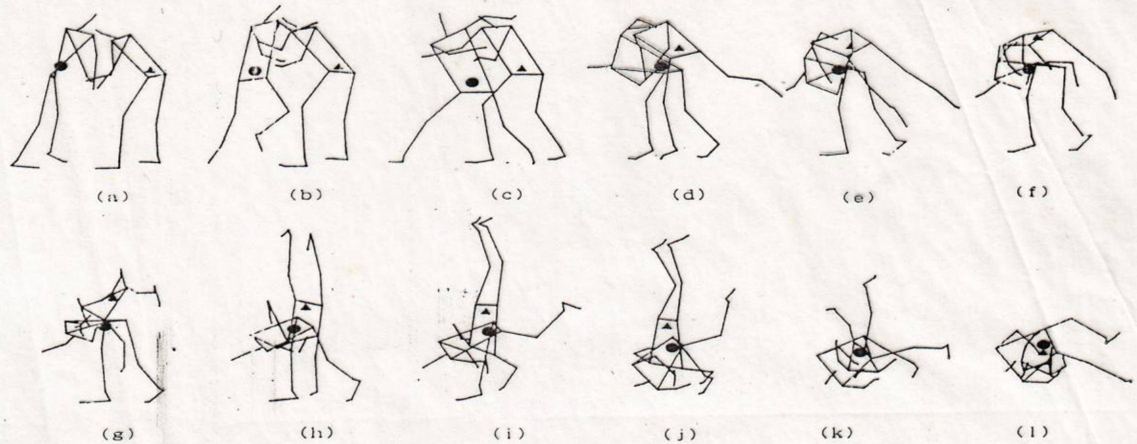


図5　3回戦における古賀選手の大腰のスティックピクチャー
(●は古賀選手，▲は相手選手の身体重心の位置)

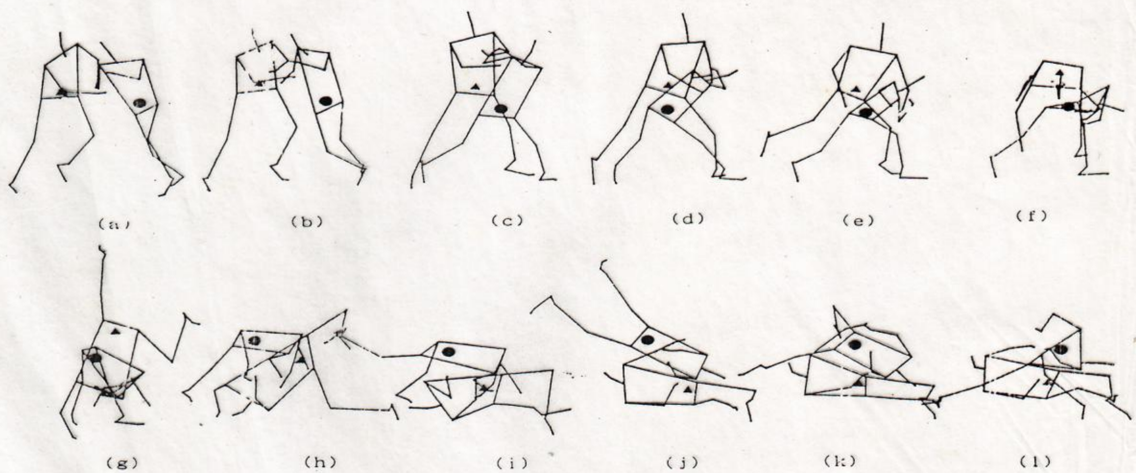


図6　準決勝における古賀選手の袖釣り込み腰のスティックピクチャー
(●は古賀選手，▲は相手選手の身体重心の位置)

Stick figure Judo

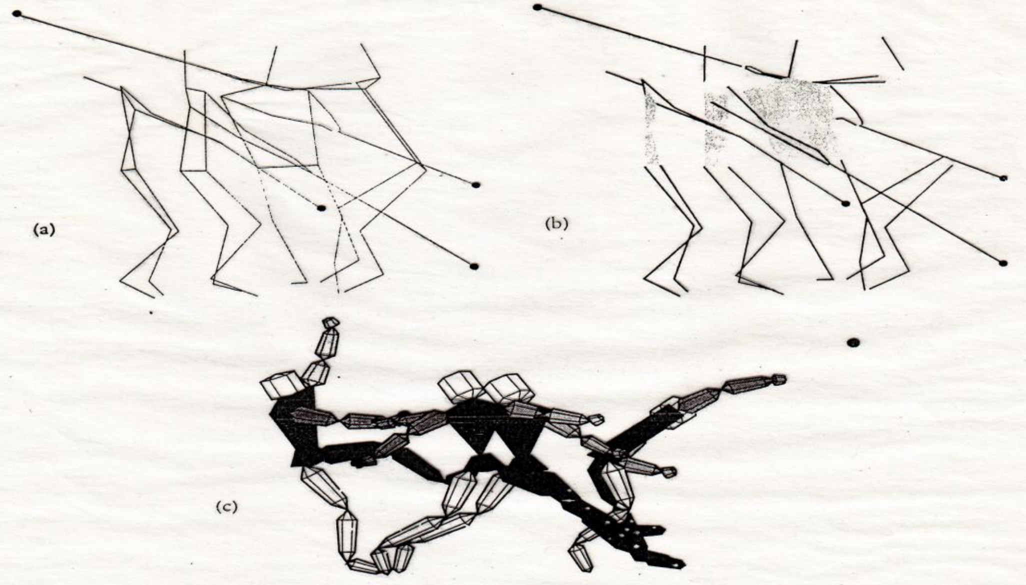


Figure 5.4 Computer visualization: (a) stick figure of hammer thrower; (b) as (a) but with body shading and hidden line removal; (c) solid body model of cricket fast bowler.

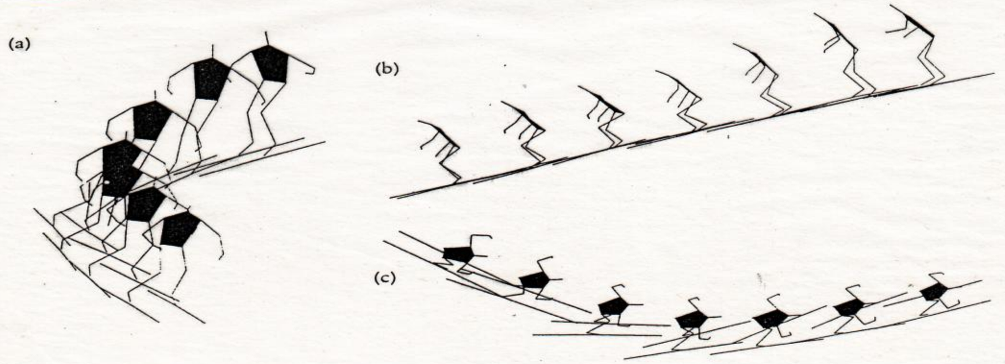


Figure 5.3 Stick figure sequences of a skier: (a) front view; (b) side view; (c) top view.

Visualisasi komputer

3D Pan & Tilt Specifications

Power Source

- 12V DC, 1 A

Power Consumption

- Approximately 12 watts maximum

Digital Encoding Unit (DEU) Input

- Video:
  —One Camera NTSC, PAL, or Peak High-Speed Video System (120 Hz)

DEU Output

- Video:
  —Two Video outs. One for local viewing and one for event synchronization

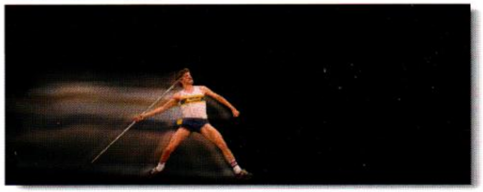
Camera

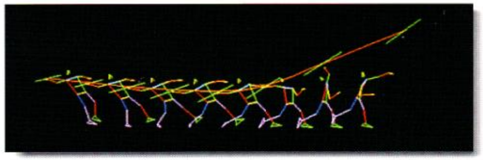
- Any camera with Gen-lock and shutter

Range Poles

- Any make of range poles is permissible

Instead of constraining movement to the camera's field of view (above), the Peak 3D Pan & Tilt Module lets you follow the movement in its entirety (center). The Peak5 System then reads in the coordinates as if it were a stationary camera (below).

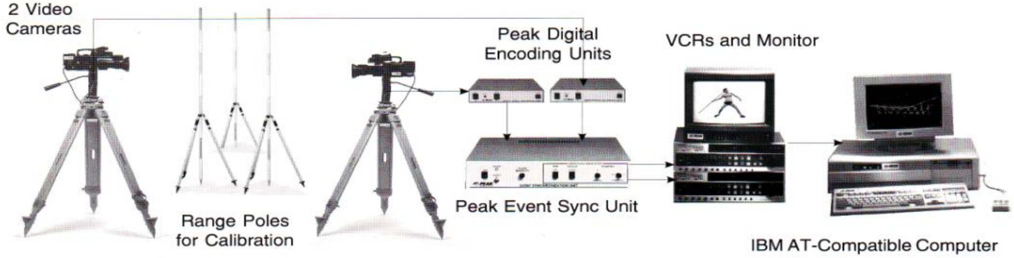




Tripod

- Any make or model of surveying tripod can be used as long as it can be properly leveled and has a 5/8 x 11 mounting stud.

3D Pan & Tilt Module Calibration Setup



PEAK®
PERFORMANCE TECHNOLOGIES INC.

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The Qualisys Motion Capture System

Qualisys Medical offers an end-user Gait Analysis product that can be used for clinical as well as research studies. The user can choose to run standard protocols or develop their own methods and routines. All parts, both hardware and software, are designed to give the user a complete package – from data capture to analysis.

Methods and calculations

The user can define their own marker configuration or use an already implemented standard setup (Helen Hayes or 6DOF (6 Degrees of Freedom).

Once the marker setup is defined, kinematic and kinetic calculations can be performed and standard parameters such as joint angles, moments and power can be reported.

Other typical gait parameters are speed, stride length, step length/time, stance and swing phase.

Patient from St. Jozef Instituut in Antwerpen, The Netherlands

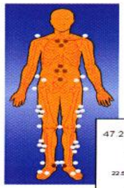
Reporting and visualization

One of the key functions of the system is the presentation of the parameters. The results can be saved and reported in standard or customized graph layouts and comparisons between different patients and groups can be done. Several visualization functions are implemented. Motion data can be shown as skeletons, mannequins or user-defined animations.

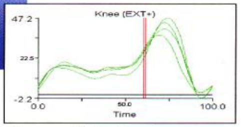
References

University College Salford	Department of Rehabilitation Dr. Jim Richards
University of Surrey	School of Mechanical and Materials Engineering Dr. David Ewins
University of Massachusetts	Biomechanics Laboratory Dr. Joel Hamill
St. Jozef Instituut	Department of Rehabilitation Dr. Andre Adam
G.A.I.T. – Gait Analysis in Trondheim	Geir Otherhals

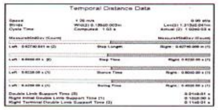
2005-04-21



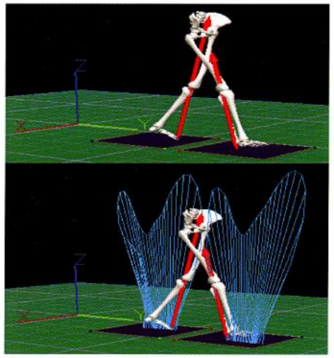
Marker setup for Gait Analysis



Right knee angle in saggital plane



Gait Parameters



Visualization of motion data

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