Hip98 database

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- Measurement of forces
- Calculation of muscle and joint forces
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HIP98

Loading of the Hip Joint

Version 5 for **Windows 7**, September 2011

Contact Forces

G. Bergmann et al.

Julius Wolff Institute
Charité – Universitätsmedizin Berlin

Muscle Forces

G.N. Duda, M.O. Heller

Julius Wolff Institute
Charité – Universitätsmedizin Berlin

Gait Analysis

G. Deuretzbacher

Clinical Biomechanics

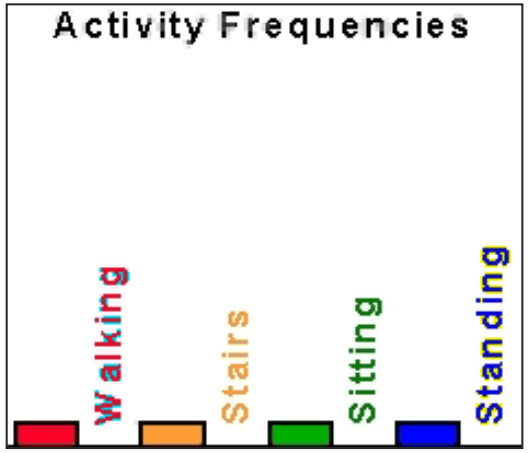
University of Hamburg

Patient Activities

M. Morlock et al.

Biomechanics Section

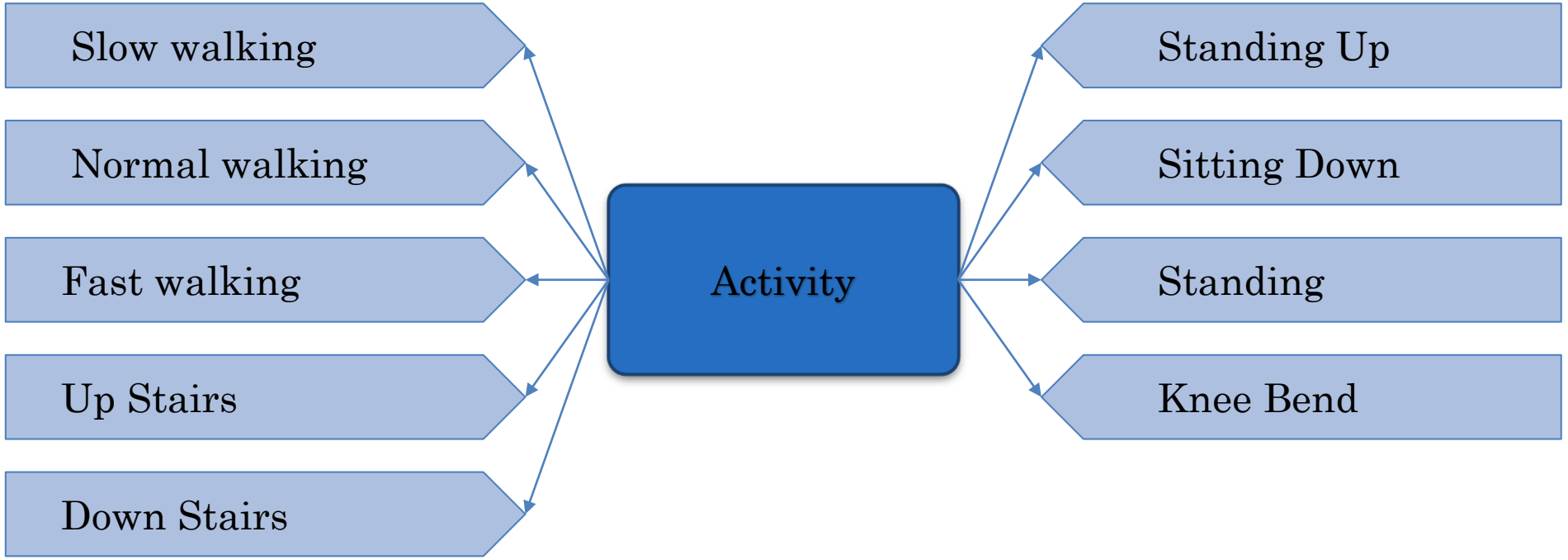
Techn. Univ. Hamburg-Harburg



What database contains ?

- Forces acting in the hip joint during the most common activities
- Database provides
  - Gait analysis data
  - Calculated muscle forces
  - EMG signals
  - Number of frequencies of different activities

Activities



Patients

H. Sonke (HSR)

P. Fichtner (PFL)

K. Walter (KWR)

I. Bohme (IBL)

Hip replacement

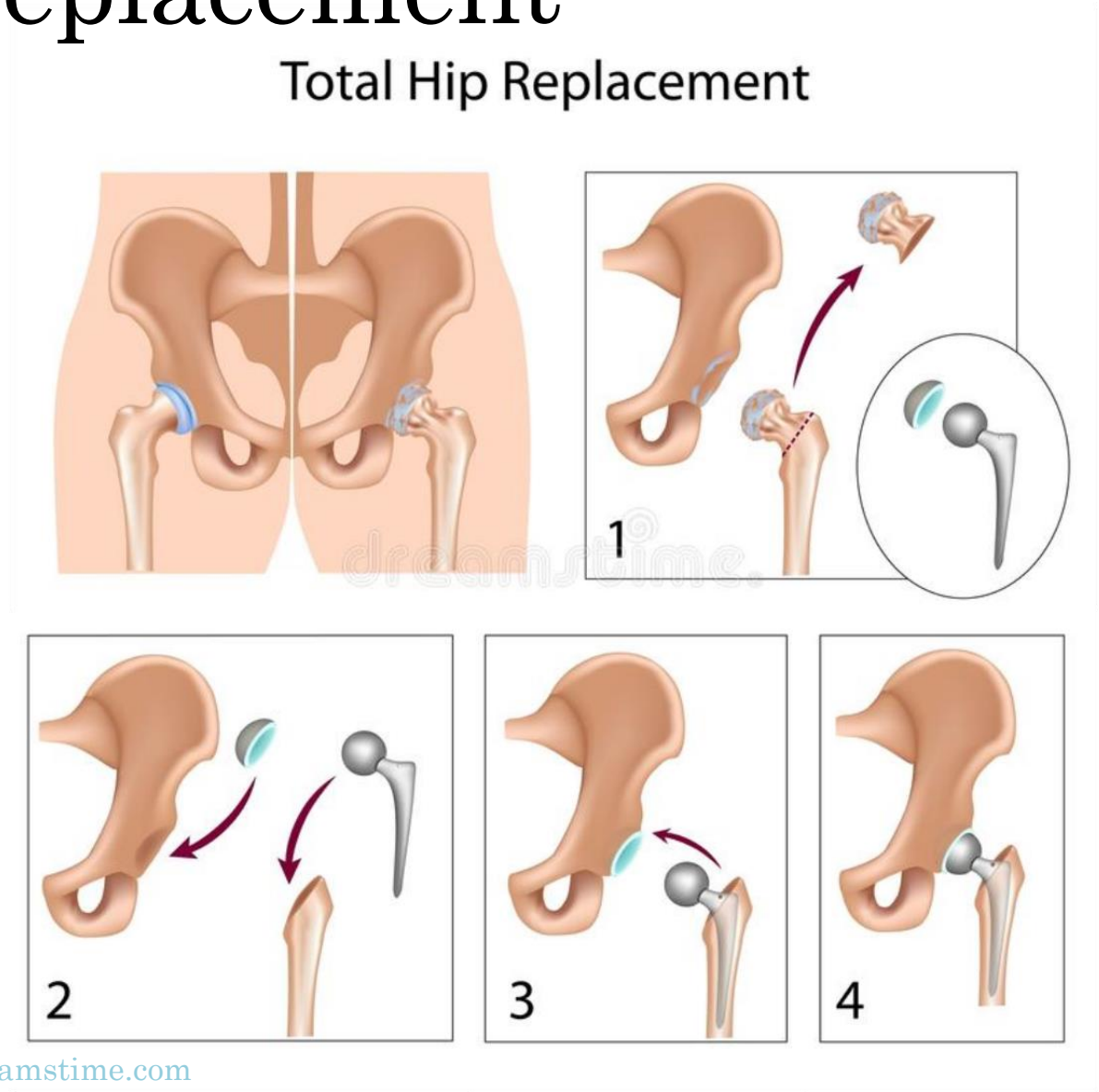
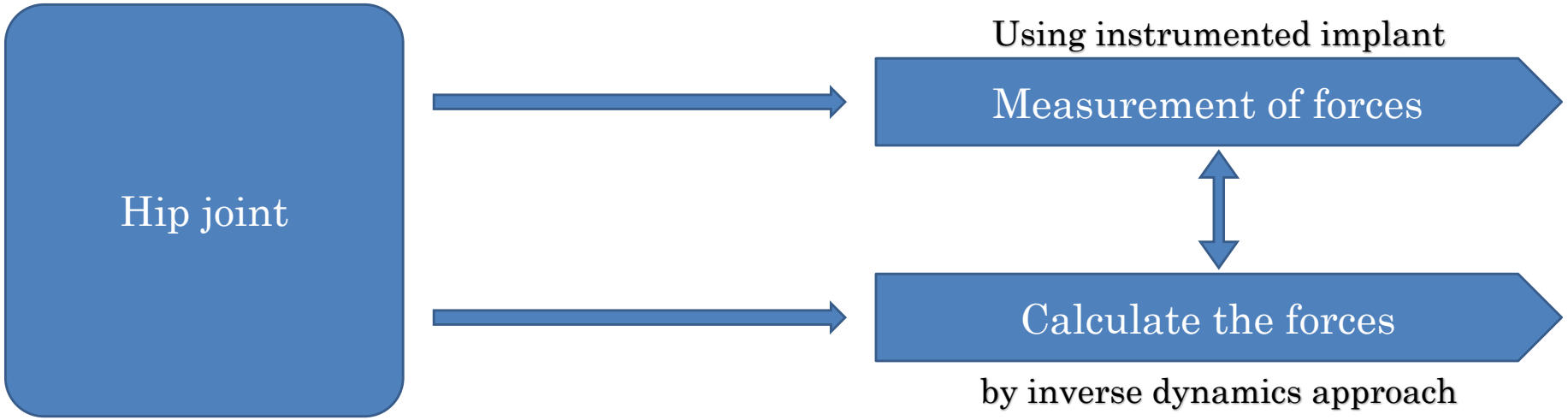


Image Source: http://dreamstime.com

Measured hip contact force



Measurement of forces

Instrumented implant

Hip implant I

Hip implant II

Image Source: http://www.wiki.orthoload.com

Instrumented implant

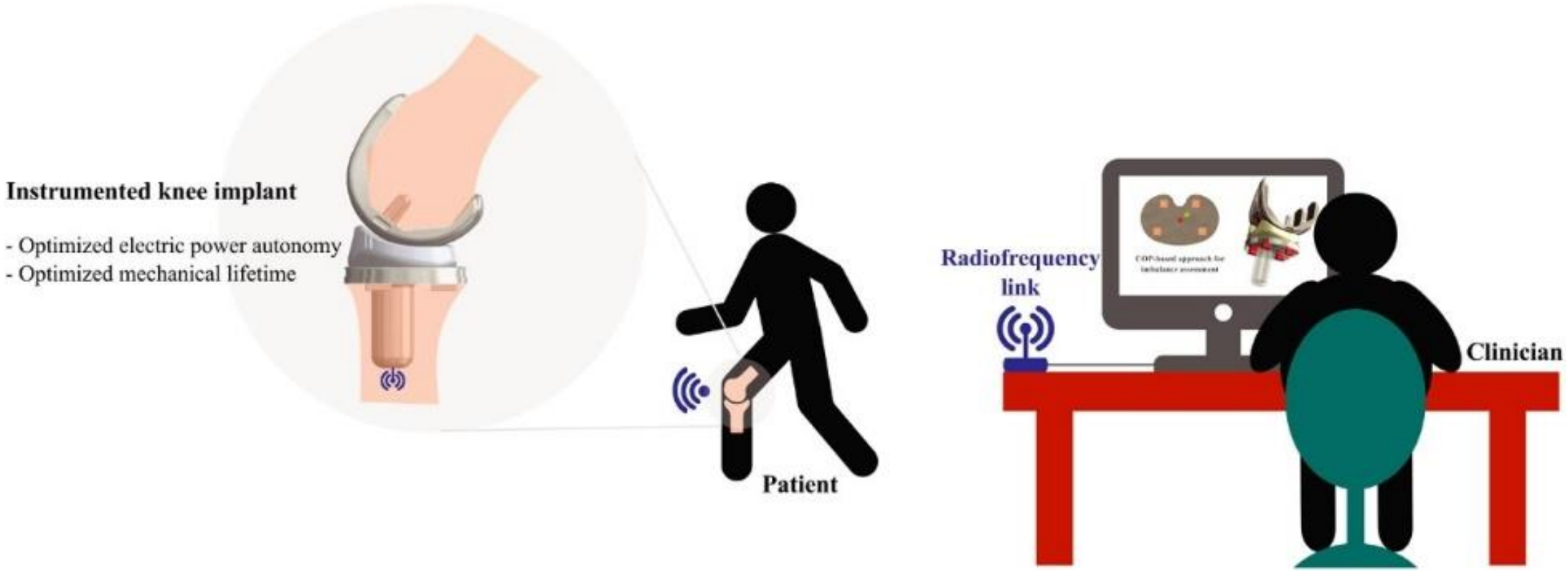


Image Source: http://www.wiki.orthoload.com

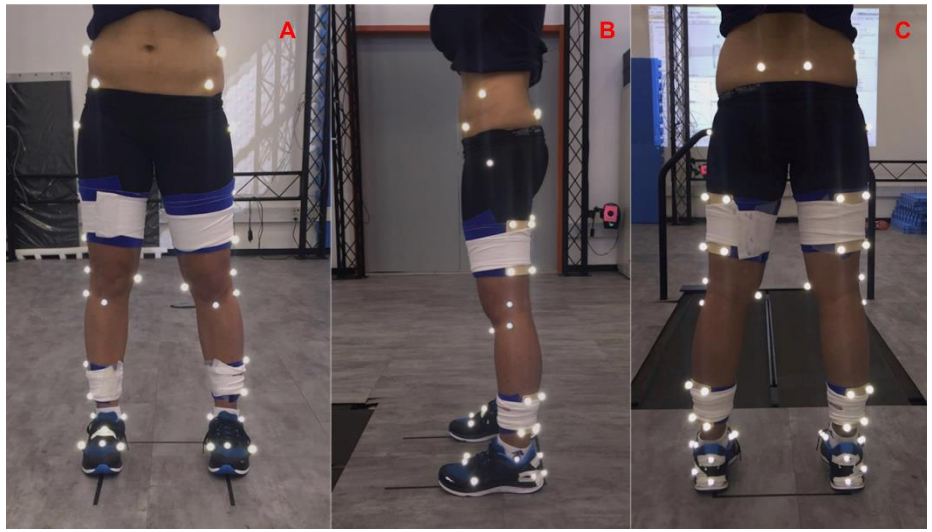
Estimation of muscle forces

Musculoskeletal model

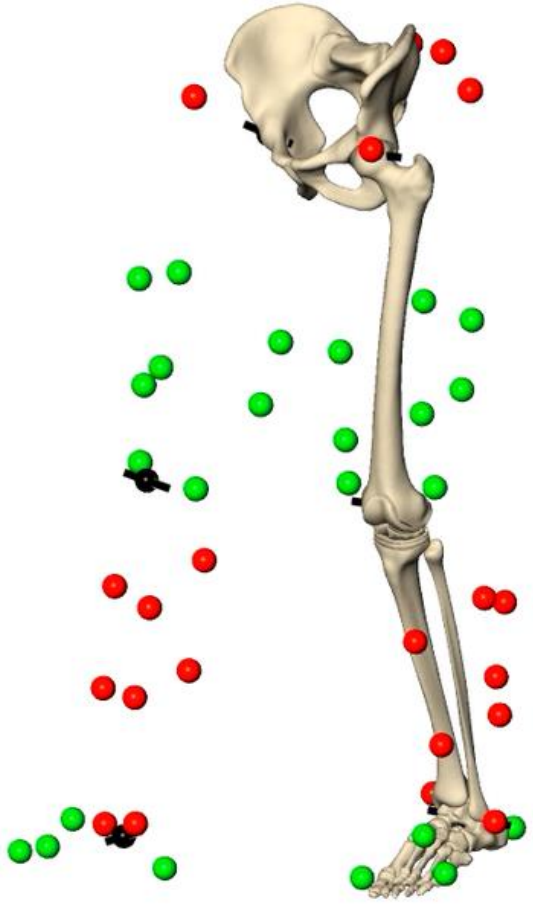
- Musculoskeletal computer models apply mechanical principles to a system composed of bones, muscles and ligaments in order to estimate internal loading conditions.

Image Source:: Heller et al., (2001).

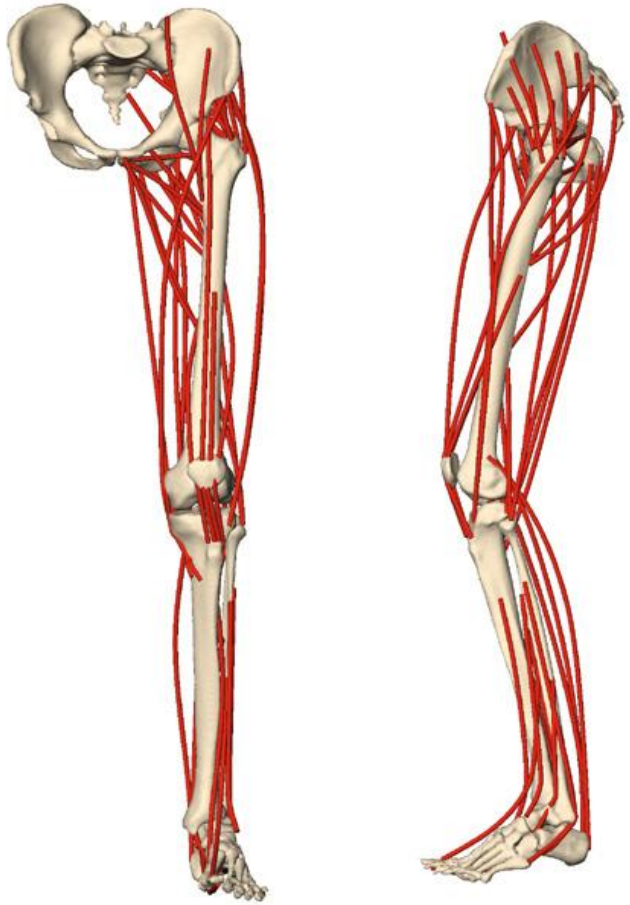
Musculoskeletal model



Experimental markers on subject during gait

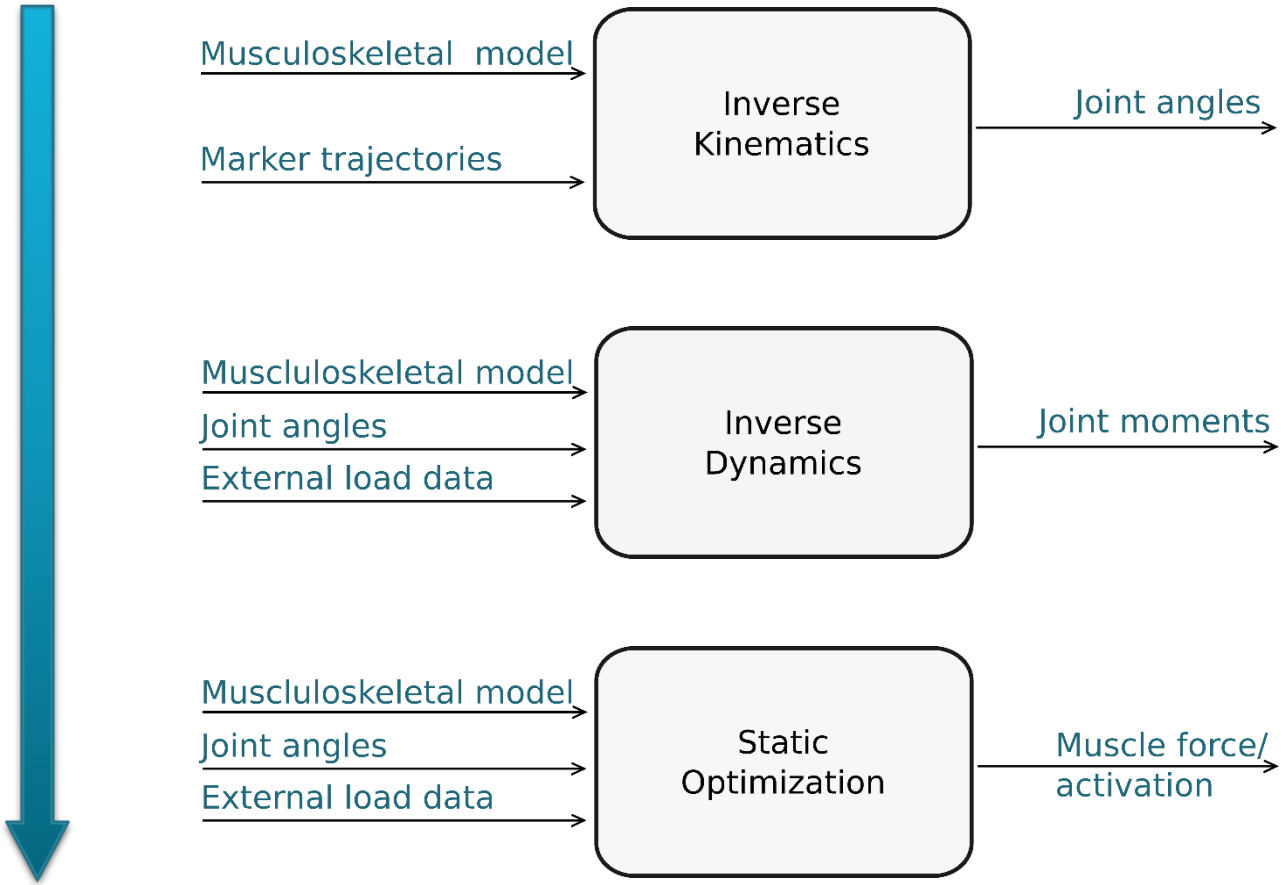


Markers on lower limb model



Musculoskeletal load

Estimation of muscle forces



Inverse dynamics

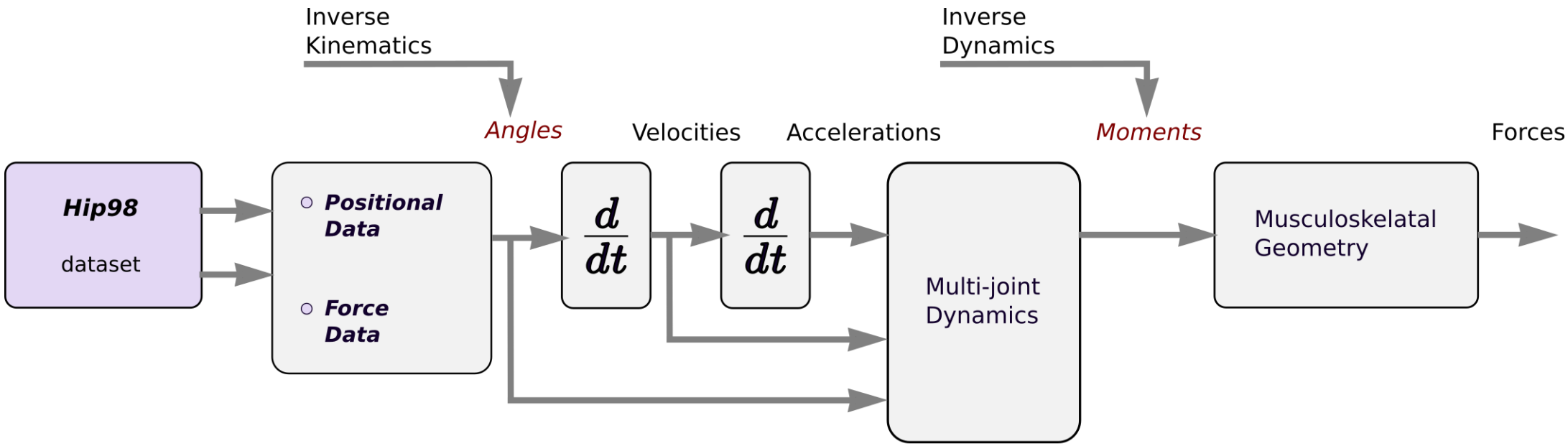


Fig. Schematic overview of inverse kinematics and inverse dynamics problem

Download *‘HIP98’*

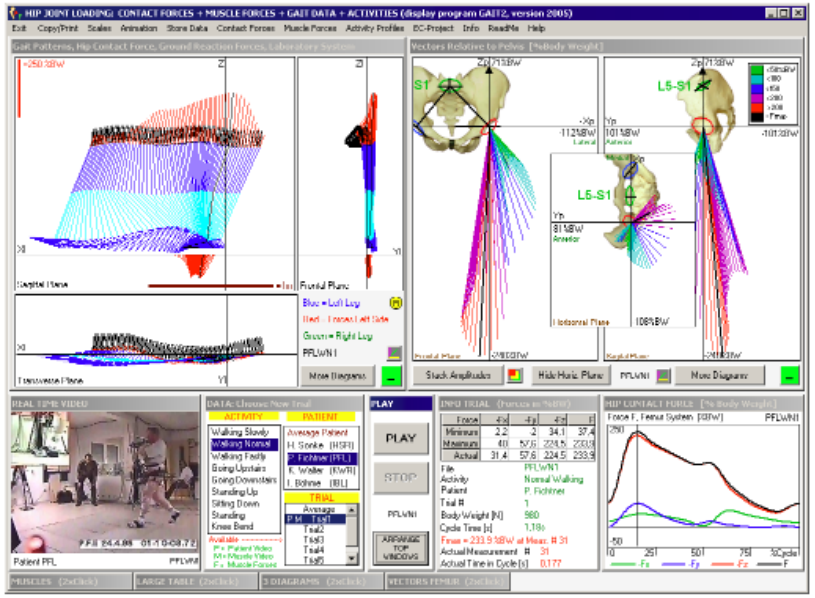
Download *'HIP98'*

OrthoLoad

Loading of Orthopaedic Implants

Data collection 'HIP98'

Data collection 'HIP98'



The data collection CD-ROM **HIP98** contains the forces acting in the hip joint during the most common activities of daily living. Measurements were taken 1998 in 4 subjects. In addition to the implant loads and the synchronous videos of the subjects (as in OrthoLoad), this database provides gait analysis data, calculated muscle forces, EMG signals and numbers for the frequencies of the different activities (show abstract of Bergmann et al., 2001).

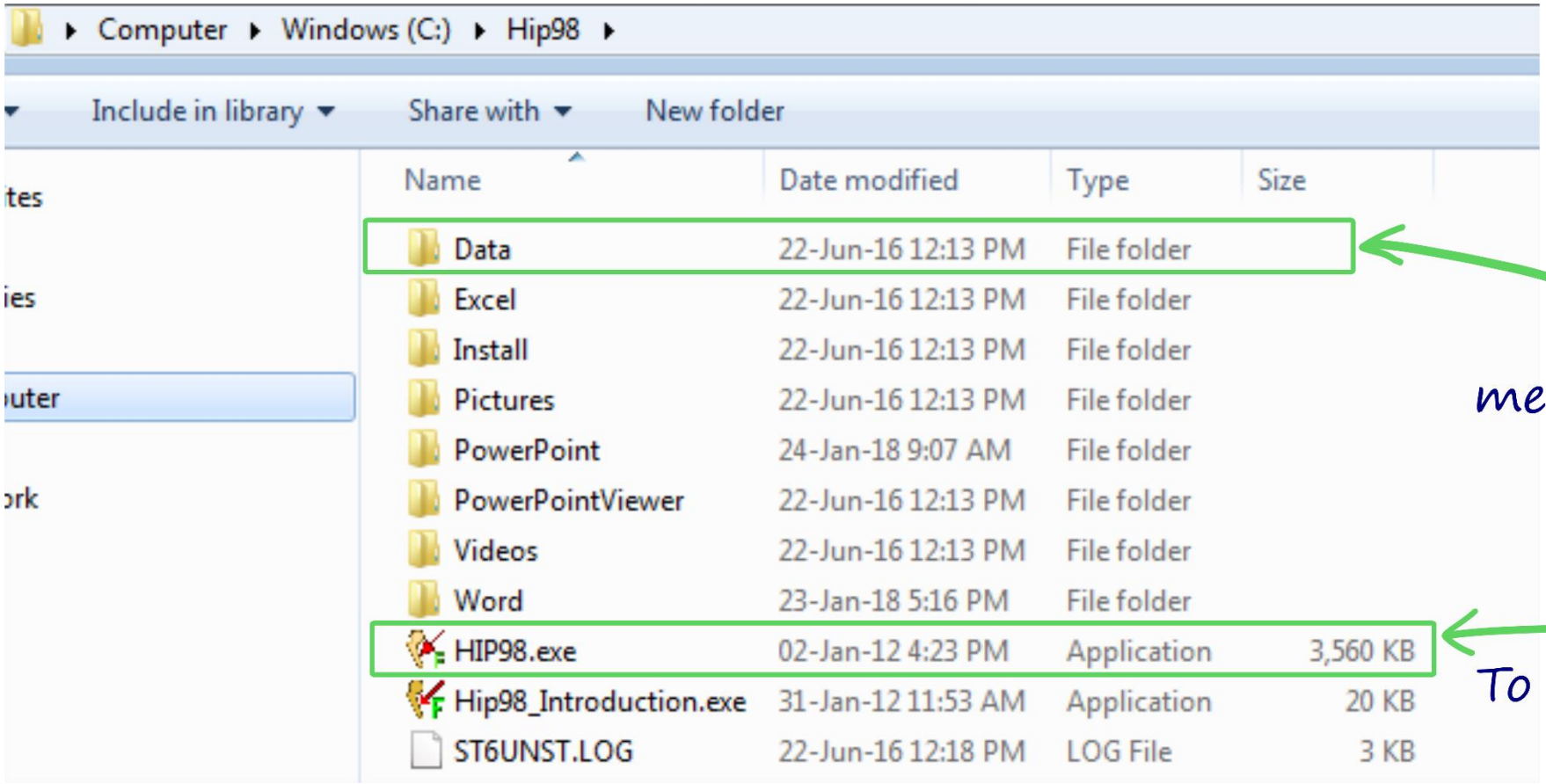
The forces acting at the acetabulum, i. e. the pelvic side of the hip joint, were additionally determined, using the forces acting relative to the femur plus the belonging gait analysis data. From the results of the individuals, the loads acting in a 'typical' or representative subject are also provided.

download HIP98

for MS Windows 7 (175MB)

There is NO VIRUS in the hip98.zip file. You can check the MD5 checksum to make sure the downloaded hip98.zip file is secure. MD5 Checksum: 1969d60a24aec25df2cafec1fe74de97 or [md5 check file]

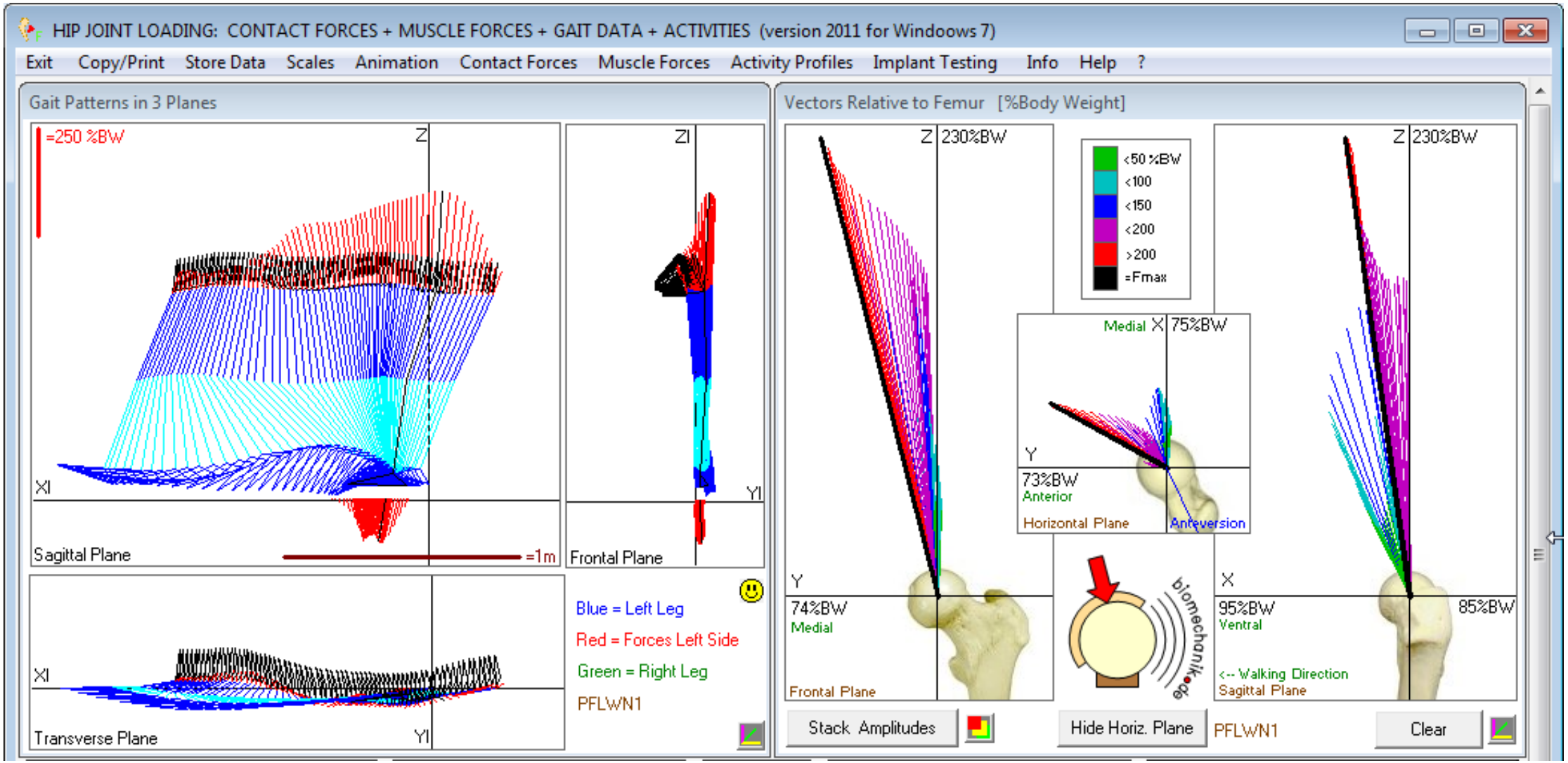
Folder structure *'HIP98'*



measured gait and GRF data

To run GUI of the program

GUI *'HIP98'*


HIP JOINT LOADING: CONTACT FORCES + MUSCLE FORCES + GAIT DATA + ACTIVITIES (version 2011 for Windoows 7)
Exit
Copy/Print
Store Data
Scales
Animation
Contact Forces
Muscle Forces
Activity Profiles
Implant Testing
Info
Help
?
Gait Patterns in 3 Planes
=250 %BW
Z
XI
Sagittal Plane
=1m
ZI
YI
Frontal Plane
XI
Transverse Plane
YI
Blue = Left Leg
Red = Forces Left Side
Green = Right Leg
PFLWN1
Vectors Relative to Femur [%Body Weight]
Z 230%BW
<50 %BW
<100
<150
<200
>200
=Fmax
Medial X 75%BW
Y
73%BW
Anterior
Horizontal Plane
Anteversion
Y
74%BW
Medial
Frontal Plane
biomechanik
X
95%BW
Ventral
<-- Walking Direction
Sagittal Plane
Z 230%BW
85%BW
Stack Amplitudes
Hide Horiz. Plane
PFLWN1
Clear

Data *'HIP98'*

C:> Hip98 > Data > GaitAndForce > HSRWN1.TXT

HSRWN1																
	TIME	ON-CAL-L	ON-CAL-R	ON-K-L	ON-K-R	GLUMA-L	TENFA-L	QUAFE-L	BICFE-L	TIBAN-L	GLUMA-R	TENFA-R	QUAFE-R	BICFE-R	TRISU-L	
	0	1	-1	1	-1	719.1001	388.2	161.05	86.6001	1522.6001	185.6001	147.75	115.25	441.3501	362.1001	
	0.0052	1	-1	1	-1	732.191	382.571	163.5851	86.4441	1536.926	178.203	143.239	121.958	438.2561	369.3801	
	0.0104	1	-1	1	-1	745.282	376.942	166.1201	86.288	1551.2521	170.806	138.728	128.666	435.162	376.6601	
	0.0156	1	-1	1	-1	758.373	371.313	168.655	86.132	1565.578	163.409	134.2169	135.374	432.068	383.9401	
	0.0208	1	-1	1	-1	771.6	365.884	170.994	86.062	1581.828	155.8859	130.1739	141.5621	427.642	391.4401	
	0.026	1	-1	1	-1	785.575	361.555	172.255	86.465	1608.6599	147.67	128.7049	144.8901	415.89	400.1501	
	0.0312	1	-1	1	-1	799.5499	357.226	173.516	86.868	1635.492	139.454	127.236	148.2181	404.138	408.8601	
	0.0364	1	-1	1	-1	813.525	352.8969	174.7769	87.271	1662.3239	131.238	125.767	151.5461	392.386	417.5701	
	0.0416	1	-1	1	-1	831.8959	348.5039	176.4099	87.638	1675.804	124.762	124.662	155.5621	380.474	424.8921	
	0.0468	1	-1	1	-1	860.1579	343.9669	178.8799	87.924	1659.242	122.201	124.376	161.1261	368.202	429.0911	
	0.052	1	-1	1	-1	888.4199	339.4299	181.3499	88.21	1642.6799	119.64	124.0899	166.69	355.93	433.29	
	0.0572	1	-1	1	-1	916.6819	334.8929	183.8199	88.4959	1626.1179	117.079	123.8039	172.254	343.6581	437.489	
	0.0624	1	-1	1	-1	939.7779	327.74	186.4579	88.4699	1597.286	115.682	123.8059	177.164	327.3961	441.418	
	0.0676	1	-1	1	-1	956.8469	317.5349	189.292	88.0799	1554.1391	115.643	124.1439	181.311	306.4791	445.032	
	0.0728	1	-1	1	-1	973.916	307.33	192.126	87.6899	1510.9921	115.604	124.4819	185.458	285.5621	448.6459	
	0.078	1	-1	1	-1	990.985	297.125	194.96	87.2999	1467.845	115.565	124.8199	189.6049	264.6451	452.2599	
	0.0832	1	-1	1	-1	1005.326	288.352	197.362	86.4939	1415.6021	115.23	124.758	192.6719	250.8081	452.8019	
	0.0884	1	-1	1	-1	1017.962	280.4739	199.494	85.428	1357.674	114.7101	124.446	195.0639	241.396	451.424	
	0.0936	1	-1	1	-1	1030.5979	272.5959	201.626	84.362	1299.746	114.19	124.134	197.4559	231.984	450.0461	
	0.0988	1	-1	1	-1	1043.2339	264.7179	203.758	83.296	1241.818	113.6701	123.822	199.8479	222.5719	448.6681	
	0.104	1	-1	1	-1	1043.08	257.6699	206.51	82.73	1185.88	113.2001	123.62	202.8499	213.9199	448.0501	
	0.1092	1	-1	1	-1	1039.089	250.8709	209.448	82.314	1130.5391	112.745	123.451	206.0349	205.4959	447.6601	
	0.1144	1	-1	1	-1	1035.098	244.072	212.386	81.898	1075.1981	112.29	123.2821	209.2199	197.072	447.2701	
	0.1196	1	-1	1	-1	1031.1071	237.273	215.3241	81.482	1019.8571	111.8351	123.1131	212.4049	188.648	446.8801	
	0.1248	1	-1	1	-1	999.5521	227.594	215.8621	81.714	978.6281	110.528	122.8841	216.2019	176.168	459.4501	
	0.13	1	-1	1	-1	965.7001	217.675	216.2001	82	938.5751	109.15	122.65	220.0499	163.35	473.1001	
	0.1352	1	-1	1	-1	931.8481	207.7561	216.5381	82.286	898.5221	107.772	122.416	223.8979	150.532	486.7501	
	0.1404	1	-1	1	-1	899.7601	196.9821	216.6021	82.455	858.238	106.457	122.1789	227.7059	137.9949	499.2691	
	0.1456	1	-1	1	-1	888.8401	175.9481	213.3781	81.22	815.1821	105.898	121.9059	231.034	128.83	498.2161	
	0.1508	1	-1	1	-1	877.9201	154.914	210.154	79.985	772.126	105.3391	121.6329	234.362	119.665	497.1631	
	0.156	1	-1	1	-1	867.0001	133.88	206.93	78.7501	729.07	104.7801	121.3599	237.69	110.5	496.11	
	0.1612	1	-1	1	-1	851.8771	116.131	203.229	77.6531	690.286	104.1071	120.9399	240.265	103.7469	494.829	
	0.1664	1	-1	1	-1	822.7441	109.332	197.938	77.0161	665.742	103.0541	120.0299	240.33	105.0339	492.788	
	0.1716	1	-1	1	-1	793.6111	102.533	192.647	76.3791	641.198	102.0011	119.1199	240.395	106.3209	490.747	
	0.1768	1	-1	1	-1	764.478	95.734	187.3561	75.7421	616.6541	100.9481	118.2099	240.46	107.6079	488.706	

Notations of Gait data Files *'HIP98'*

C:> Hip98 > Data > GaitAndForce > HSRWN1.TXT

INFOS

Measured and Calculated Variables

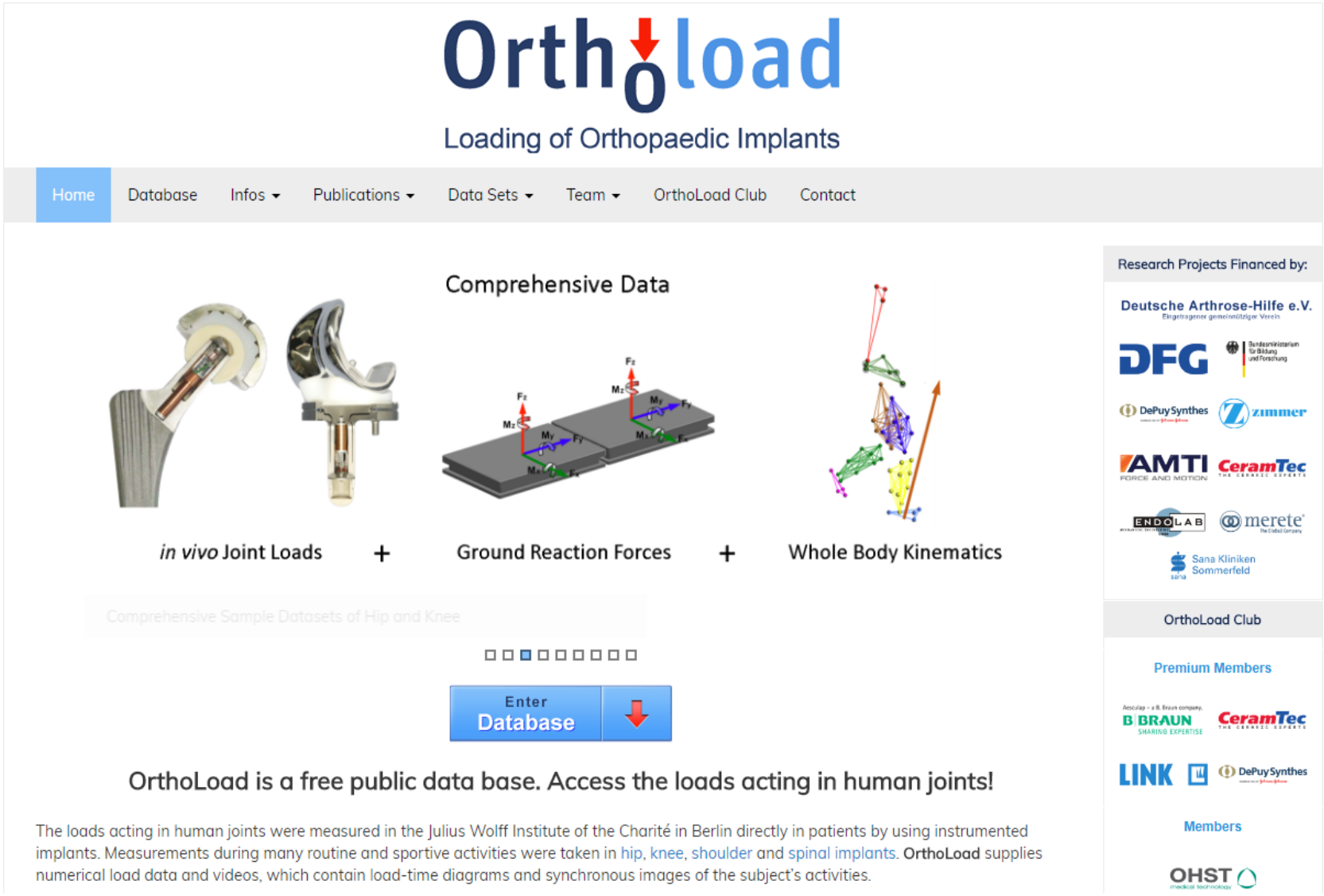
Number
Number of variable

"Var.# Right → Left"
Var# New variable# after right instrumented joint is transformed to left joint.
-Var# Sign of variable changed after transformation from right to left.

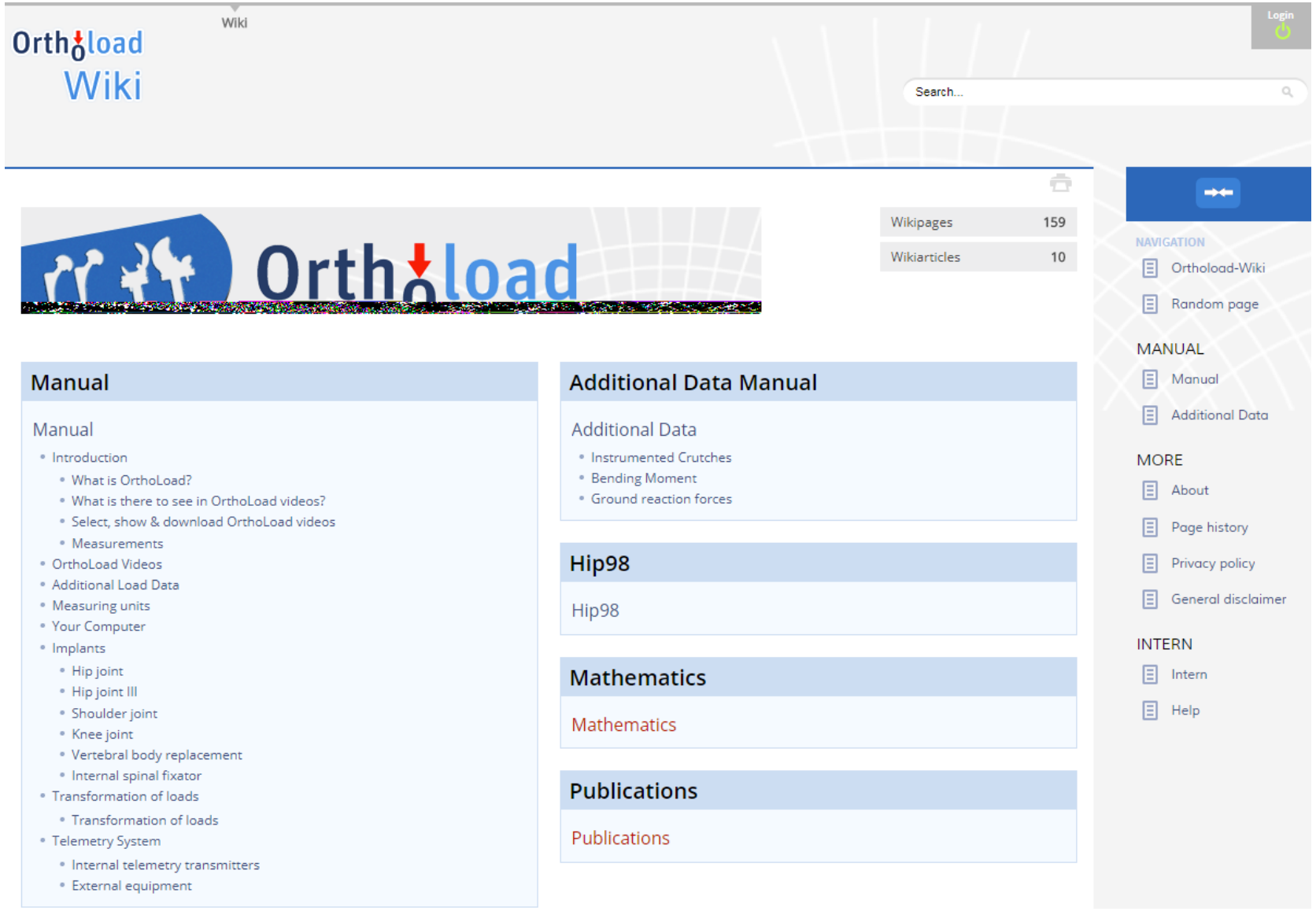
Num	Variable Name	Description	Body Side	Coordinate System	Axis	Units	Var.# Right → Left
1	TIME	Time				s	1
2	ON-CAL-L	Calcaneus on Ground	Left			1	3
3	ON-CAL-R	Calcaneus on Ground	Right			1	2
4	ON-K-L	Foot on Kistler Plate	Left			1	5
5	ON-K-R	Foot on Kistler Plate	Right			1	4
6	GLUMA-L	m.glutaeus max. (EMG)	Left			Rel.U.	11
7	TENFA-L	m.tens.fasc.lat. (EMG)	Left			Rel.U.	12
8	QUAFE-L	m.quadric.fem.(EMG)	Left			Rel.U.	13
9	BICFE-L	m.biceps fem.(EMG)	Left			Rel.U.	14
10	TIBAN-L	m.tibialis ant. (EMG)	Left			Rel.U.	10
11	GLUMA-R	m.glutaeus max. (EMG)	Right			Rel.U.	6
12	TENFA-R	m.tens.fasc.lat. (EMG)	Right			Rel.U.	7
13	QUAFE-R	m.quadric.fem.(EMG)	Right			Rel.U.	8
14	BICFE-R	m.biceps fem.(EMG)	Right			Rel.U.	9
15	TRISU-L	m.triceps surae (EMG)	Left			Rel.U.	15
16	F-KL-LAB-X	Ground Reaction Force	Left	Lab.	x	%BW	**23**
17	F-KL-LAB-Y	Ground Reaction Force	Left	Lab.	y	%BW	**- 24**
18	F-KL-LAB-Z	Ground Reaction Force	Left	Lab.	z	%BW	**25**
19	M-KL-LAB-Z	Moment of Gr.R.Force	Left	Lab.	z	%BW*m	- 26
20	P-KL-LAB-X	Point Gr.R.Force	Left	Lab.	x	m	27
21	P-KL-LAB-Y	Point Gr.R.Force	Left	Lab.	y	m	- 28
22	P-KL-LAB-Z	Point Gr.R.Force	Left	Lab.	z	m	29

Useful online resources

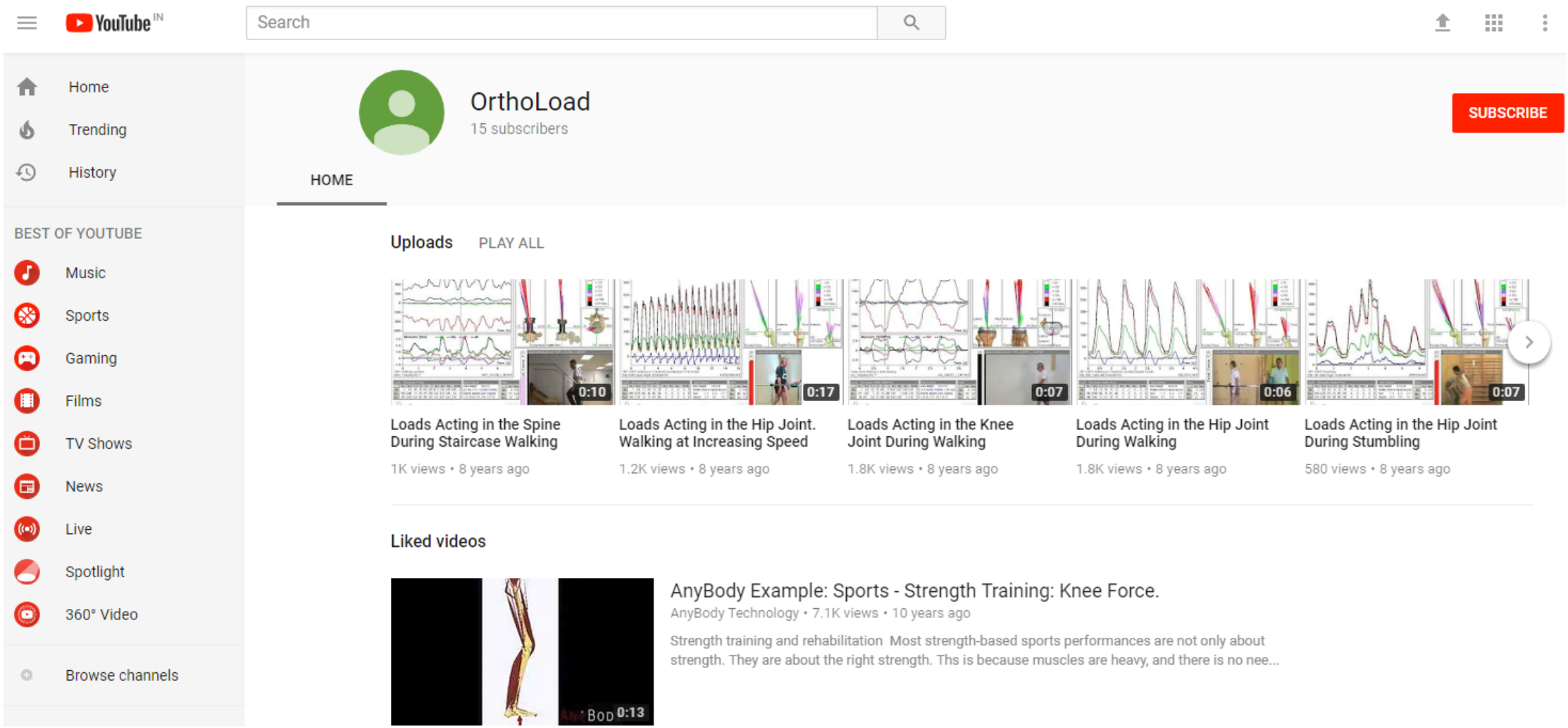
www.orthoload.com



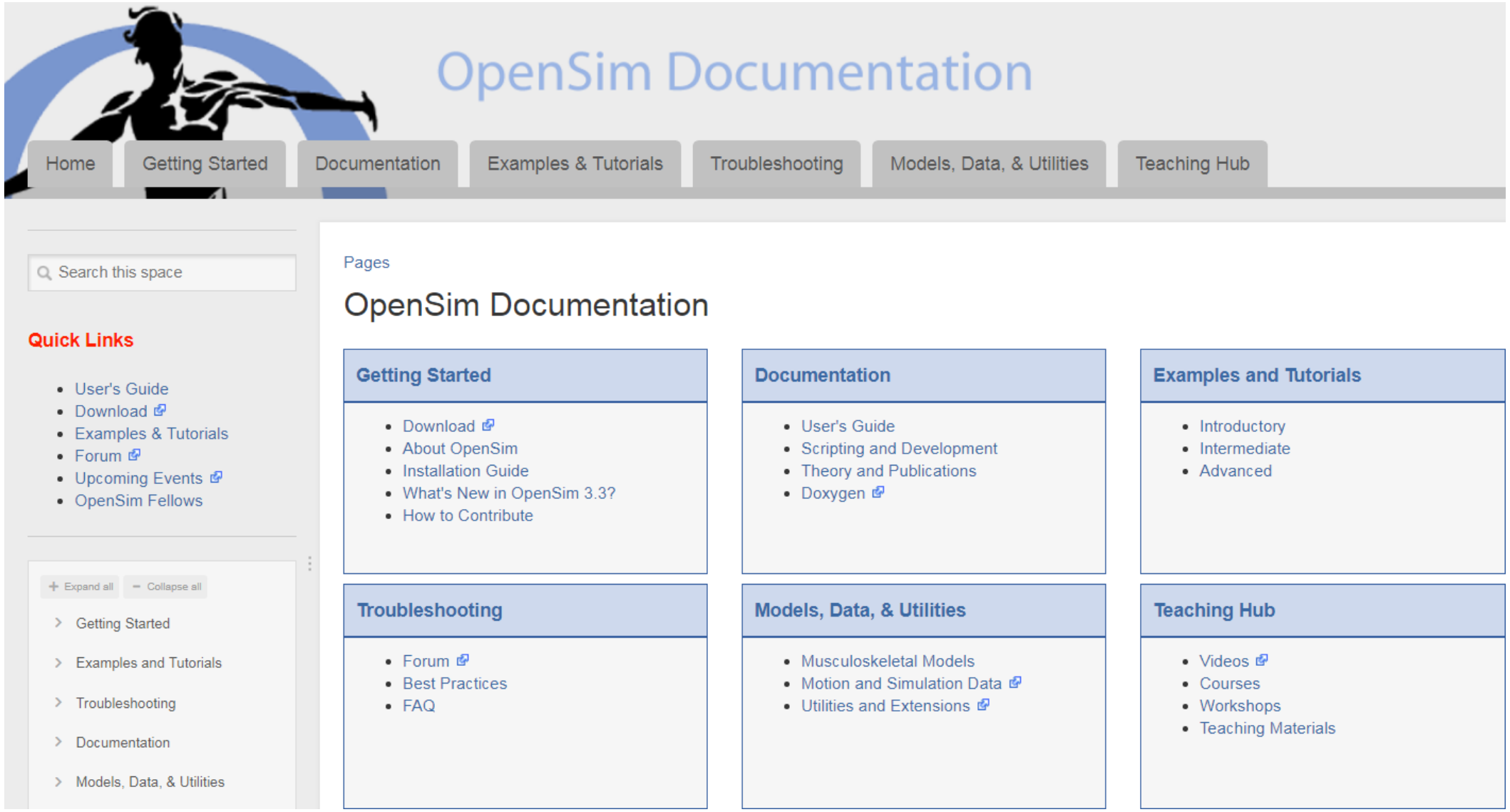
www.wiki.orthoload.com



www.youtube.com/user/OrthoLoad



www.simtk-confluence.stanford.edu



Literatures

ELSEVIER

Journal of Biomechanics 34 (2001) 859–871

JOURNAL OF BIOMECHANICS

www.elsevier.com/locate/jbiomech
www.JBiomech.com

Hip contact forces and gait patterns from routine activities

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[b] *Gait Laboratory, Orthopaedic Hospital, University of Hamburg, Germany*
[c] *Research Laboratory, Trauma and Reconstructive Surgery, Charité, Humboldt University of Berlin, Germany*

Accepted 22 February 2001

Abstract

In vivo loads acting at the hip joint have so far only been measured in few patients and without detailed documentation of gait data. Such information is required to test and improve wear, strength and fixation stability of hip implants. Measurements of hip contact forces with instrumented implants and synchronous analyses of gait patterns and ground reaction forces were performed in four patients during the most frequent activities of daily living. From the individual data sets an average was calculated. The paper

Literatures

ELSEVIER

Journal of Biomechanics 34 (2001) 883–893

JOURNAL OF BIOMECHANICS

www.elsevier.com/locate/jbiomech
www.JBiomech.com

Musculo-skeletal loading conditions at the hip during walking and stair climbing

M.O. Heller[a,b], G. Bergmann[c], G. Deuretzbacher[d], L. Dürselen[b], M. Pohl[b], L. Claes[b], N.P. Haas[a], G.N. Duda[a,*]

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[b] *Institute for Orthopaedic Research and Biomechanics, University of Ulm, Germany*
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Accepted 22 February 2001

Abstract

Musculo-skeletal loading plays an important role in the primary stability of joint replacements and in the biological processes involved in fracture healing. However, current knowledge of musculo-skeletal loading is still limited. In the past, a number of musculo-skeletal models have been developed to estimate loading conditions at the hip. So far, a cycle-to-cycle validation of

End

Thank you