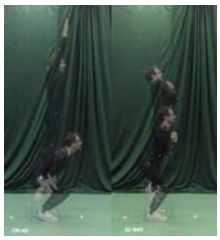
DAM Cursus Klinische Video/Foto-Analyse Springen

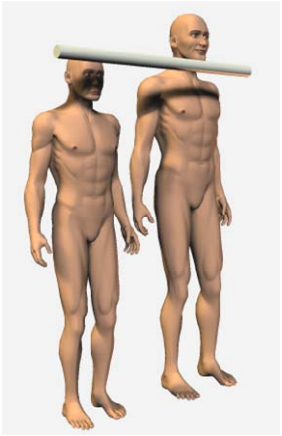


Chris Riezebos
Aad Lagerberg

www.damcursus.nl

2.45 meter
Javier Sotamayor (1993)

2.09 meter
Stefka Kostadinova (1987)



Fair Play ???

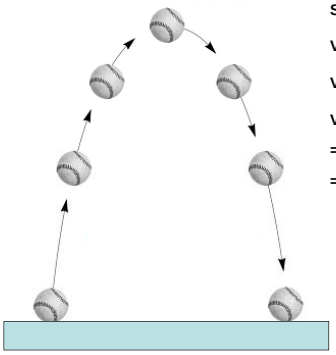
Wereldrecord vrouwen: Kostadinova
Lichaamslengte 1.80
Spronghoogte 2.09
Verschil: 29 cm

Franklin Jacobs
Lichaamslengte 1.73 meter
Spronghoogte 2.32 meter
Verschil: 59 cm.

Stefan Holm
Lichaamslengte 1.81 meter
Spronghoogte 2.40 meter
Verschil: 59 cm.

Het wereldrecord mannen: Javier Sotamayor
Lichaamslengte 1.95
Spronghoogte 2.45
Verschil: 50 cm

Niki Bakoyanni
Lichaamslengte 1.71 meter
Spronghoogte 2.03 meter
Verschil: 32 cm.



Stijgtijd = valtijd = zweeftijd/2

$Vy_{top} = 0$

Valweg = spronghoogte (s) =

Vy_{top} * valtijd + ½ g.valtijd^2

= ½ * 9,81*(zweeftijd/2)^2

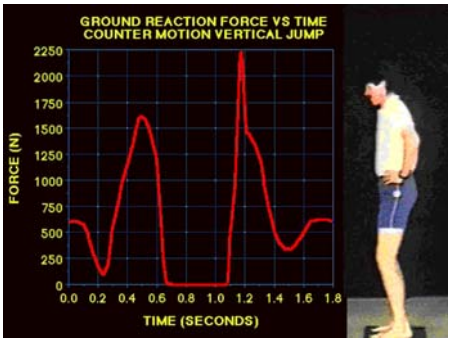
= 1,225*zweeftijd^2

$$S = V_0 t + \frac{1}{2} a t^2$$

Spronghoogte uit video-analyse:

Methode 1: Zweeftijd bepalen (frames tellen in vluchtfase)

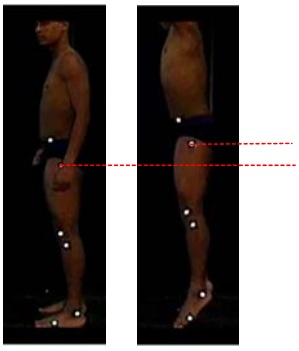
Framerate 240fps
Start vlucht : 302
Eind vlucht : 460
Vluchttijd = 158*1/240 = 0,6583 sec
Spronghoogte = 1,225 *0,6583^2 = 53 cm



Spronghoogte uit video-analyse:

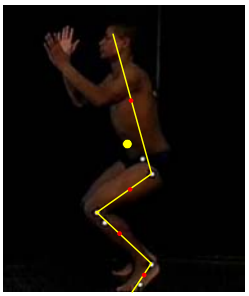
Methode 2 en 3: (hoogteverschil heupmarker (direct of via tracking)

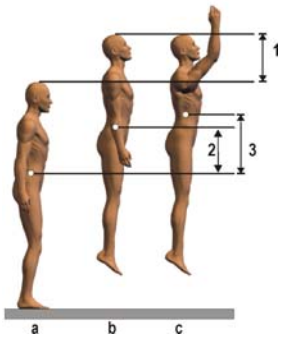
Beide methoden kennen verschillende definities voor spronghoogte

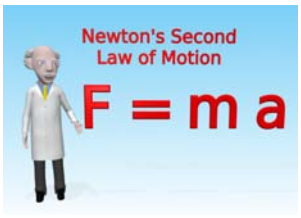


Sprongshoogte uit video-analyse:

Methode 4: (hoogteverschil lichaamszwaartepunt)

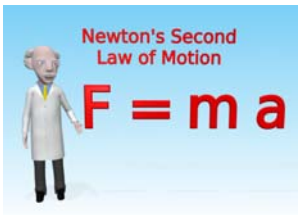






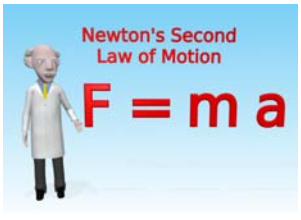
F staat voor de resulterende Kracht op het lichaam

Fr = -Fz
Geen resulterende kracht. Dus geen versnelling
Het lichaam is in rust of……



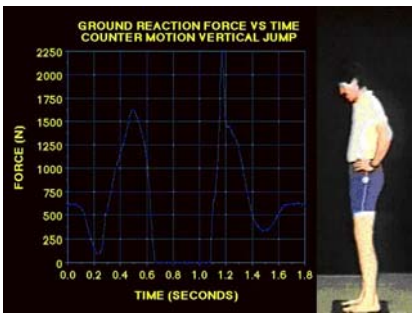
F staat voor de resulterende Kracht op het lichaam

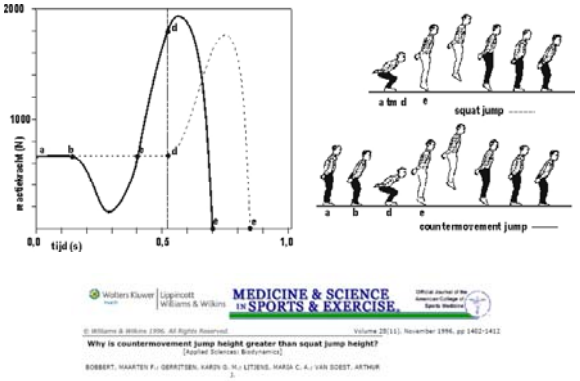
Fr < Fz
Resulterende neerwaartse kracht. Dus heerst er een neerwaartse versnelling
wat zegt dit over de snelheid?

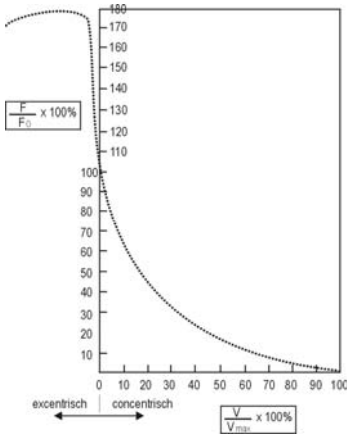


F staat voor de resulterende Kracht op het lichaam

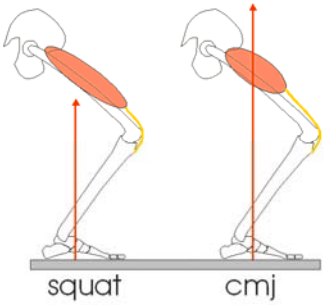
Fr > Fz
Resulterende opwaartse kracht. Dus heerst er een opwaartse versnelling
Wat zegt dit over de snelheid?







Curve van Hill
Kracht-snelheidsrelatie



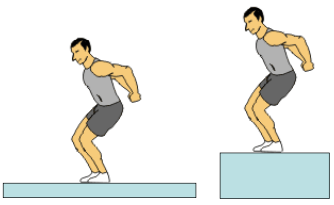
De sponghoogte wordt bepaald door de Energie-inhoud van het lichaam op het moment van take-off.

Kinetische energie
Potentiële energie

$$E_k = \frac{1}{2}mv^2$$

$$E_{pot} = m \cdot g \cdot h$$

Toename van de potentiële energie bij take-off



Toename van de potentiële energie bij take-off

Effect armheffen op LZP ongeveer 3-4 cm

Journal of Sports Sciences, 1999, **17**, 449–466

Upper extremity augmentation of lower extremity kinetics during countermovement vertical jumps

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JOURNAL OF BIOMECHANICS

Understanding how an arm swing enhances performance in the vertical jump

Adrian Lees[a,*], Jos Vanrenterghem[b], Dirk De Clercq[b]

JOURNAL OF BIOMECHANICS

The effect of arm swing on lower extremities in vertical jumping

Mikiko Hara[a,*], Akira Shibayama[b], Daisuke Takeshita[c], Senshi Fukashiro[a]

The effect of arm swing on lower extremities in vertical jumping

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Squat jump

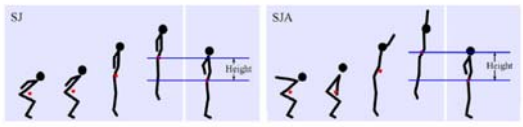


Fig. 1. Stick pictures for two types of jump. SJ: squat jump with no arm swing. SJA: squat jump with arm swing. The jump height was defined as the maximum displacement of the CM of the body (the dots in the figures) from the standing position.

Gemiddeld effect van armzwaai op spronghoogte = 10,1 cm
SJ = 44,5 cm. SJA = 54,6 cm.

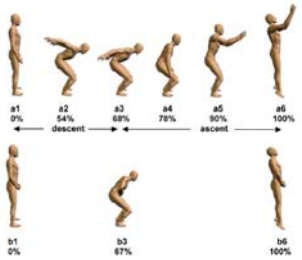
JOURNAL OF BIOMECHANICS

Understanding how an arm swing enhances performance in the vertical jump

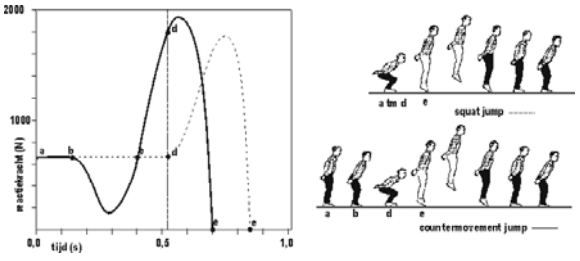
Adrian Lees[a,*], Jos Vanrenterghem[b], Dirk De Clercq[b]

Countermovement jump

Conclusie:
Het effect van de armzwaai op de spronghoogte is groter dan verklaarbaar is door de toename van potentiële energie van de geheven armen.



Gemiddeld effect van armzwaai op spronghoogte = 8,6 cm
44,6 cm. versus 53,2 cm.



Wolters Kluwer | Lippincott Williams & Wilkins
MEDICINE & SCIENCE IN SPORTS & EXERCISE

Volume 28(11), November 1996, pp 1402-1412

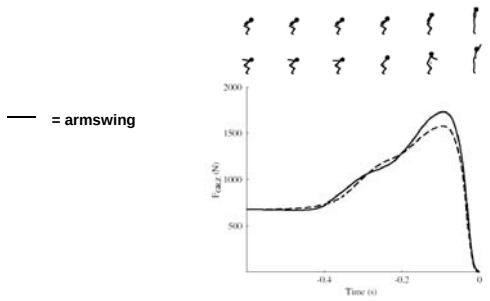
Why is countermovement jump height greater than squat jump height?

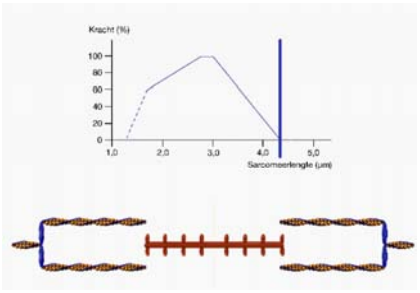
[Applied Sciences: Biodynamics]

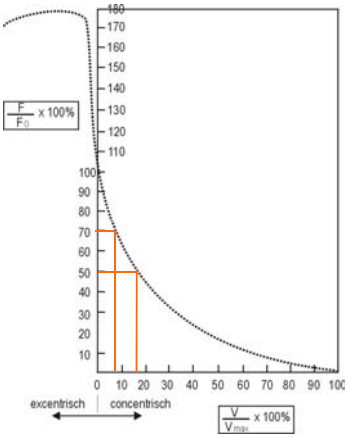
BOBBERT, MAARTEN F.; GERRITSEN, KAREN G. H.; LITJENS, MARIA C. A.; VAN SOEST, ARTHUR J.

The effect of arm swing on lower extremities in vertical jumping

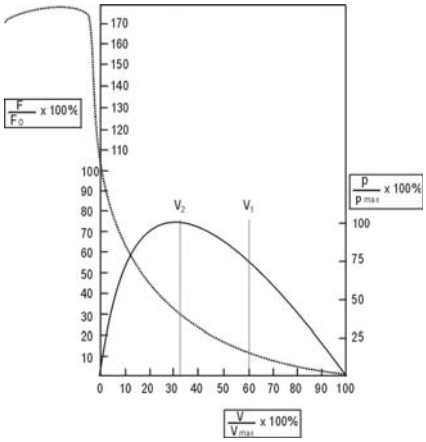
Mikiko Hara[a,*], Akira Shibayama[b], Daisuke Takeshita[c], Senshi Fukashiro[a]

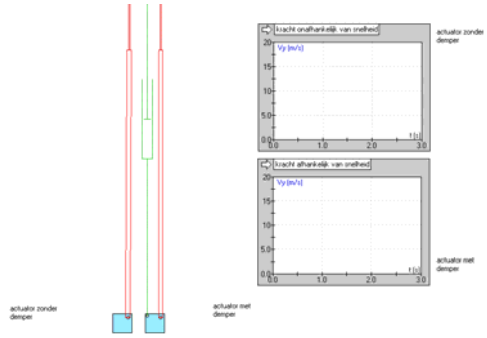


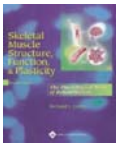




Curve van Hill
Kracht-snelheidsrelatie







R.L. Lieber
ISBN 0-7817-30619

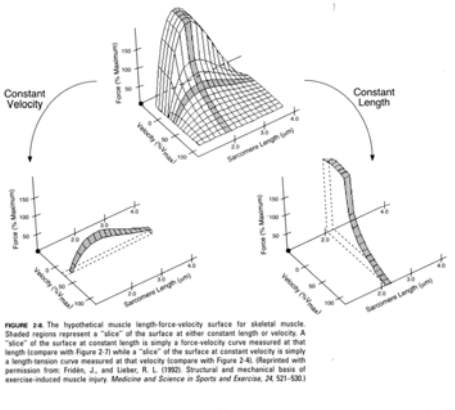
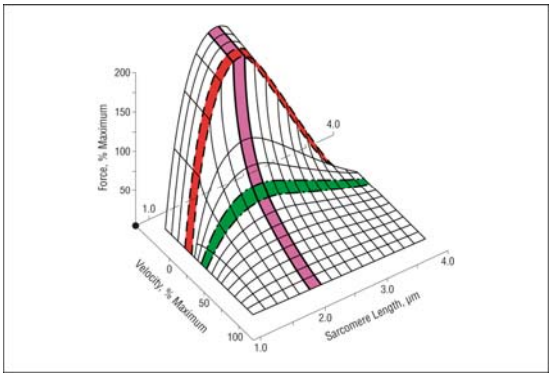
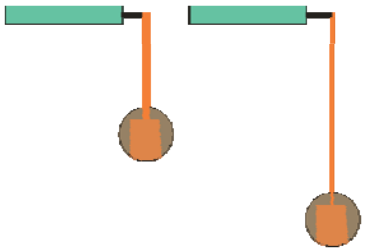


FIGURE 2-8. The hypothetical muscle length-force-velocity surface for skeletal muscle. Shaded regions represent a "slice" of the surface at either constant length or velocity. A "slice" of the surface at constant length is simply a force-velocity curve measured at that length (compare with Figure 2-7) while a "slice" of the surface at constant velocity is simply a length-tension curve measured at that velocity (compare with Figure 2-6). (Reprinted with permission from: Friden, J., and Lieber, R. L. (1992). Structural and mechanical basis of exercise-induced muscle injury. *Medicine and Science in Sports and Exercise, 24*, 521-530.)



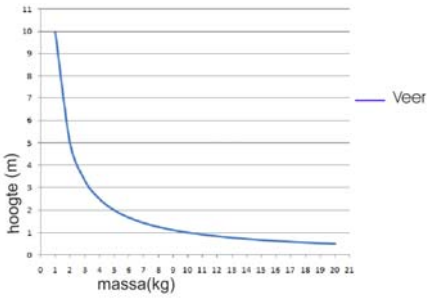
Energie in elastiek is constant dus
M.g.h = constant

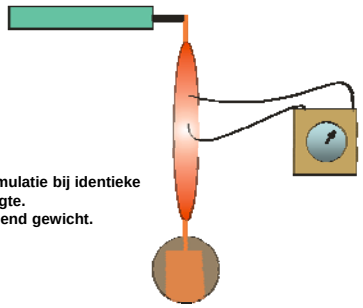
Stel kg komt 10 meter hoog
Pot energie = 100 Nm
2 kg komt dan 5 meter hoog



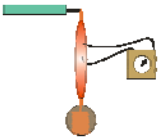
De potentiële energie is constant

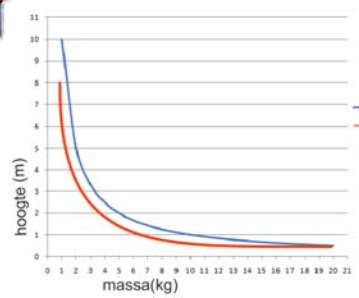
massa	hoogte	pot energie
1	10	100
5	2	100
10	1	100
15	0,666667	100
20	0,5	100





Max stimulatie bij identieke startlengte.
Toenemend gewicht.

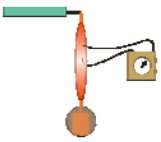




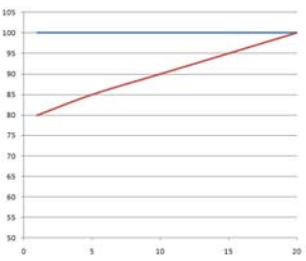
massa	hoogte	pot energie
1	10	100
5	2	100
10	1	100
15	0,666667	100
20	0,5	100

massa	hoogte	energie
1	8	80
5	1,7	85
10	0,9	90
15	0,63333	95
20	0,5	100

De energie die de spier aan de steen weet te geven is niet constant.
Bij grotere gewichten presteert de spier beter!



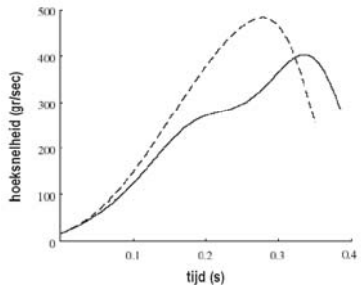
E pot

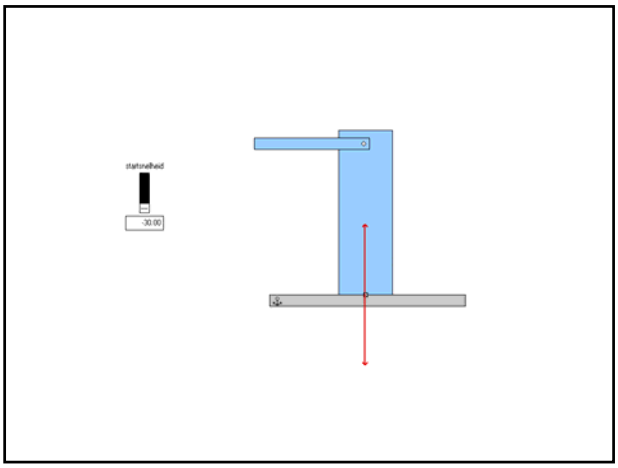


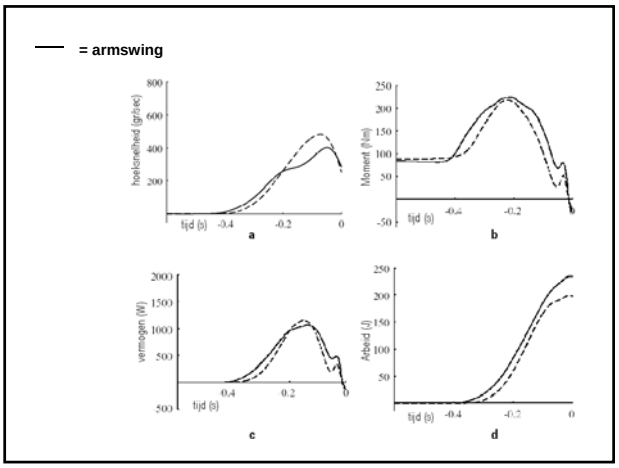
massa	hoogte	pot energie
1	10	100
5	2	100
10	1	100
15	0,666667	100
20	0,5	100

massa	hoogte	energie
1	8	80
5	1,7	85
10	0,9	90
15	0,63333	95
20	0,5	100

= armswing




startsnelheid
-30.00


= armswing
hoeksnelheid (gr/sec)
tijd (s)
a
Moment (Nm)
tijd (s)
b
vermogen (W)
tijd (s)
c
Arbeid (J)
tijd (s)
d