

Calculations

Graphics

The following graphics are from the [CalTester Paper](#) Holden JP, Selbie WS, Stanhope SJ, "A proposed test to support the clinical movement analysis laboratory".



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Section I : Calculating the rod orientation variable under the assumed condition of static equilibrium

Free-body diagram of testing device: F_p , ground reaction force; F_g , gravitational force (weight); F_a , applied force; r , position vector between tips (p to a) of testing device rod:



Thus, r and A are parallel and the test device rod orientation θ is defined entirely by the vector quantity A that is derived from FP measurements (F_p) and the physical characteristics of the testing device ($F_g/2$, i.e. the weight of the rod and its center of mass location; in this case, half the rod length).



The rod orientation variable (θ) is determined from the dot product of the unit vector along A and the unit vector aligned with the long axis of the rod θ as determined using the motion capture components.

Section II : Equation for evaluating the static equilibrium assumption

Under 2D dynamic conditions, the following holds:



Rewriting the left-hand side of Eq. (4)



Rearranging Eq. (5), the magnitude of the angular displacement (θ) between vectors r and A due exclusively to the inertial terms can be isolated:



where r is the length of the testing device rod, I_{cg} the moment of inertia of the test device rod about

the center of mass location, m the mass of the testing device rod and α is the angular acceleration of the testing device rod relative to an inertial reference frame.

CalTesterPlus does not calculate α since it operates under the assumption that there is no angular acceleration. For this reason it is important to move the CalTester rod slowly at a constant speed.

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Last update: **2024/06/26 20:12**

