# Mathematical Kinesiology:

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## Objectives:

- The formulation of a mathematical structure capable of storing the dynamical state of a human body, with all of its degrees of freedom, capable of undergoing actions/transformations to reflect possible changes in that configuration (transformations in a body-configuration space of possible movements?)

https://www.youtube.com/watch?v=LnM74brIZPE- Biomechanics Introduction

^ Established biomechanical principles can form the rules of the possible transformations of the body

What about the dimensions/size/physical geometry of the body? Can we somehow find a set of parameters (eg. height, shoulder width, distance between eyes, muscle mass) that span the set of all possible human bodies? Just how big is that set? How many independent parameters can the physical body of a human being have? Can there be found a spanning set that can uniquely identify the configuration of any possible human body? That can't be that hard right?

Some work has been done in **anthropometry**:

https://www.researchgate.net/publication/347460330_Anthropometry

> **Abstract**:
>
> Anthropometry is the measurement of the dimensions of the human body; for mechanical analyses the anthropometric data typically must include the mass, center of mass location, and moments of inertia of the body segments. The inertial properties are defined, followed by a review of methods for determining these inertial properties for human body segments. These methods include imaging techniques (e.g., DXA, MRI), modeling the segments as series of geometric solids, and statistical models of segmental inertial properties and segment dimensions.

So use the principles of biomechanics to create dynamical laws for the constructs populated by anthropometric data (?)

Would it be possible to generalize any unique pose/movement of one body to another morphologically different body using this system of transformations? i.e. create a 'template' of an idealized/absolute median human, and then have matrix/tensor that acts on that template to uniquely specify all the parameters discussed above?

If such a framework (albeit nebulously specified) exists, is it possible to then completely simulate (with whatever degree of accuracy is needed by the model} human movements? If a certain motion can be expressed in mathematical terms, then the transformation the motion induces in a human body must be computable - thus, any result or function we examine symbolically can also be computed and rendered visually - we can build an intuition by pairing function plots/graphs in the constructed body configuration space with a 3D visualization of the movement in question

If a 'motion' can be described as a movement of some element of the body through space, there must be a notion of velocity that can be given to the elements of the structure - can this be defined? Can that information be stored in the configuration of the human? For example, given a certain muscle-mass to bone ratio/proportions/etc (i.e. any human configuration, really), there must be some maximum amount of force that can be generated, ergo a maximum acceleration that can be generated from the availale energy (given a constant mass) and there must as well be a maximum velocity that can be reached (such as, for example, when the muscles in the throat, diaphram, etc. contract so violently during a sneeze such as to eject phlegm at speeds of almost 600m/s - that might be bullshit but it illustrates the point). The concepts of distance, velocity, and acceleration suggest that whatever structure used to define them might be somehow differentiable - is there any way to 'differentiate' the geometry of the body system to obtain these maximum possible forces?