bio-mechanics bootcamp

Introduction: These tutorials are primarily aimed to teach/review/reinforce mathematics, mechanics and programming skills to early masters or phd students (or advanced undergraduates) with a Biology background. The aim is to build on common knowledge working towards difficult and unfamiliar concepts, filling in gaps along the way. By the end of the series, students will know how to use math and programming as tools for making biological predictions (modeling) or for reaching a deeper understanding of experimental data. Topics will cover a subset of mathematical and mechanical concepts that the contributors feel are relevant to biology. You can think of it as a precursor to a course in biological system modeling (i.e. dynamic simulation courses) and as a supplement to an intro biomechanics textbook or college course. Material that is easily explained on the web or in an intro physics textbook will not be covered, assuming that students can look things up as they go. The package begins with fundamental concepts (scaling, muscle properties, limb mechanics) and will work towards static and dynamic models of muscle-tendon-bone systems. The tutorials are designed to supplement reading from biomechanics textbooks (e.g. *Animal Locomotion* by Andrew Biewener).
Note: Although it's aimed towards Biology students, Physical sciences students can also benefit. Biomechanics is not just physics or engineering. Of course, biomechanics is bound by physical laws, but it is also bound by physiological, anatomical, biochemical and evolutionary 'laws' which also must be appreciated.

What is it? This is a series of math and programming tutorials (chapters) often building on concepts covered in previous chapters. Programming is done in Mathematica. Each chapter contains a main document file as well as supplementary files (e.g. sample data and code). Many tutorials have links at the bottom of the document to useful video tutorials and/or online tools to supplement. Topics cover several (but not all) important fundamental biomechanics concepts (e.g. scaling, trigonometry, calculus, mechanics, muscle mechanics, modeling static and dynamic biological systems). Later tutorials will build on earlier tutorials in order to build a vertebrate limb model on which we can test intuition and formulate hypotheses about posture, kinematics and muscle dynamics.

How do I begin? Each tutorial chapter is a separate github repository. Click on the tutorial repository you'd like to download and click the download zip button.

The goals are...

- -to teach fundamental biomechancis concepts
- -to develop analytical and programming skills for interpretation of time-series experimental data
- -to build facility with analytical geometry, calculus and basic differential equations applied to biological systems
- -to use simple mathematical models as tools to build intuition and make predictions of biological systems

Answers to questions you may have:

Where do I find the answers to the exercises? Nowhere, for now. You'll have to get comfortable finding ways to 'reality check' your answers and verify your calculations and trust yourself. In real life research, you can't find the answer in a book or online. Eventually you'll have to error check your own calculations or those of your colleagues (e.g. reviewing a paper).
Do I have to use Mathematica for Bimechanics Bootcamp? Not necessarily. The tutorial documents will teach the math as 'pen and paper' exercises which are later reinforced by Mathematica programming. So, you can learn the concepts without using a computer. OR, you can do the programming in any other platform you like, as long as you know the basics already. Maybe eventually in the future, other contributors will adapt the tutorials for Matlab, python, R etc.

Why is this in github? I wanted an open platform for sharing as well as contributing, and it seemed much easier to set up than a wiki. Additionally, github keeps track of file version changes by various contributors so the content can grow and become updated.

How do I contribute? Experienced graduate students, postdocs, faculty, researchers, etc. are welcome to contribute, subject to some basic 'quality checking/editing' by the community of contributors. All I require is that tutorials follow a basic format (templates are provided) to keep consistency of quality and 'branding' throughout. More information on how to become a contributor will be forthcoming. All tutorial files will be in PDF format, but the document source files will be in doc or docx (or whatever editable format) located in BiomechanicsBootcamp_sourcefiles repository. Additionally, any line drawings or diagrams should also be provided in a format such as svg such that contributors can edit diagrams in Inkscape or a line art program of their choice.

Contents:
in development (coming soon)
in development (coming by and by)