**Note: the “foot angle” in the code files is the “shank angle”**

* **For detailed descriptions:**

**Please look at the supplementary materials, the main article. And please look through the thorough comments in code!**

* **Optimization Model:**

1. Go to folder “OPTIMIZATION\_MODEL”.

* **Get the optimized design:**

1. Go to file “***root\_OPTIMIZEMODEL.m***”.
2. Set up section in Line 14.
3. Set up section in Line 19.
4. Set up section in Line 31.
5. Run “***root\_OPTIMIZEMODEL.m***”.
6. Collect the output data (optimized results)

* **Run and print the five optimal-designed parameters for each keel**

1. Go to file “***root\_AFTER\_OPTIMIZATION.m***”.
2. Set up the first three sections, same as step 3-5.
3. Set up the fourth section from the optimized results from above.
4. Run “***root\_AFTER\_OPTIMIZATION.m***”.
5. Step 1-11 is only for one keel (e.g., forefoot). Go back to step 1 for another keel (e.g., hindfoot).

* **Rollover Model:**

1. Go to folder “***ROLLOVER\_MODEL\_timeFrame\_final***”.

* **Input the design from above in Section 1:**

1. Go to file “***HindFoot\_design.m***” and “***ForeFoot\_design.m***”.
2. Input the design of forefoot and hindfoot keels into these two files (all lines matter!).

* **Run the rollover model:**

1. Go to file “***root\_AFTER\_OPTIMIZATION.m***”.
2. Set up Section 2: the keel alignment, ankle alignment, and the length of the real ankle.
3. Set up Section 3: fulcrum position combinations (stiffness settings).
4. Setup Line 2: Which stiffness setting do you want to run this simulation at?
5. Run “***root\_ROLLOVERMODEL.m***”.
6. Get the result: ROS, DMAMA, EFLR, and the Animation (setup for a 1080p screen).

**Note:** There is a sample data set:

* “***all\_data\_myfile\_hindfootfulcrum\_forefootfulcrum\_alignment.mat***”**,**
* “***result\_myfile\_hindfootfulcrum\_forefootfulcrum\_alignment.mat***”.

You can first load it and only run Section 9 and have a look of the results, plots, and the animation!

* **Linear Stiffness Model:**

1. Go to folder “***Linear\_Stiffness\_Mode****l*”.
2. Open, setup Section 1 of “***root\_linearStiffnessModel.m***”, and run it.