Exercise 2.1 (A critical-thinking problem)

The linear-plus-quadratic equations of momentum (1.5) and kinetic energy (2.3a) have two algebraic solutions corresponding to geometric intersections of a momentum-line with kinetic energy ellipse or ellipses. For perfectly elastic (ka-Bong!) collisions the solutions are just INITIAL(IN) and FINAL(FIN), and similarly for perfectly inelastic (ka-Runch!) collisions, as shown in Fig. 2.3a and Fig. 2.3c, respectively.

However, for partially elastic (ka-whump!) collisions, as shown in Fig. 2.3b, there seem to be four possible intersections. One in particular is labeled as $F_{flump}$ and lies below primary solution point $F_{whump}$.

(a) Discuss $F_{flump}$ and compare to $F_{whump}$. Are both physically possible? What situation could possibly give rise to an $F_{flump}$? Think outside of the box(es) of cars and more in the realm of molecular, atomic, nuclear, and quantum particle collisions.

(b) Now, you could simulate a $F_{flump}$ on BounceIt. (That would pretty well take care of this problem!)

See if you can what is going on to have a $F_{flump}$ before trying to do such a simulation.

Exercise 2.1 (Using SUV VW graph-paper)

Continue constructions of velocity collision lines for $M_{SUV}=1$ with $M_{VW}=4$ that were started in class with initial conditions $V_{SUV}=60$ and $V_{VW}=10$ in Fig. 2.4a where the cars bounce elastically off each other or off walls at $y_0=0$ and $y_1=7$. (The $y_1$ value differs from Fig. 2.4 but is default value for simulations.) Construct 6 collisions as precisely as you can.

Use algebra to check the first four $(V_{SUV}^{FIN}, V_{VW}^{FIN})$ values of your constructions.

Construct the KE ellipse using method shown in Fig. 2.5. (You should be able to explain this method.)

To have room to do construction we recommend graphpaper labeled SUVVWprobGraphpaperToF8x10R.

Thoughtful question: At the end of collision-6 (VW with $y_1$-wall) there are two possible paths depending on where the cars are located in position space $(y_{SUV}^{FIN}, y_{VW}^{FIN})$. Discuss.

Do any of the preceding $(V_{SUV}^{FIN}, V_{VW}^{FIN})$ suffer from similar ambiguity?