

Simplified Bungee Jumping Calculations

In order to understand how fast and far a bungee jumper will fall, create an excel spreadsheet as seen below. This can be achieved by considering the energy in the system. Initially the jumper has some P.E. due to his height above ground. This is then converted into K.E. as he falls and then once the bungee chord goes tight, this is converted into S.E. In order to do this, assume the following:

- All jumper (regardless of weight) use the same bungee chord
- The bungee chord is linear with a stiffness of 100N/m
- The energy transfer is perfect – there are no energy losses due to heat/sound etc.

As such set up your analysis as follows:

Define your variables

- Bungee length
- Mass of the jumper
- Platform height
- Your calculation increment

You can then calculate the following:

- Your fall distance – these are steps increasing in the calculation increment.
- The fall distance without the bungee tightening. These are the same as your fall distance up to the bungee length (use an IF statement)
- The fall distance tightening the bungee. These are 0 until the fall distance exceeds the bungee length, and then go up by your calculation increment. (use another IF statement)
- Calculate the P.E. ($\text{mass} \times g \times \text{fall distance}$). Assume that this is zero at the start and as you fall you lose P.E. so it becomes negative.
- Calculate the S.E. ($0.5 \times \text{the stiffness of the bungee} \times \text{the fall distance tightening the bungee}^2$).
- Calculate the K.E. ($\text{K.E.} + \text{P.E.} + \text{S.E.} = 0$)
- Calculate the total energy.
- Calculate the velocity ($\text{K.E.} = 0.5 \times \text{mass} \times \text{velocity}^2$)

You can now plot the graphs shown and try changing your variables. What conclusions can you draw? Why would the real situation be different to your analysis?

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