LANDING ON AN ASTEROID

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ASSUMPTIONS AND CONSTRAINTS

Probe name: ***Star5*** with a mass (m1) of 610kg

Asteroid: ***Roculus*** with a mass (m2) of 8.0x10^11Kg

R = Distance from center of Asteroid = 25km

r = Radius of ***Roculus*** = 1.5km

Surface of Asteroid is Rigid with uneven terrain

TASKED WITH LANDING ON THE SURFACE WITH MINIMAL BOUNCE

- Microgravity

$$F = m_1 a = \frac{G(m_1 m_2)}{R^2}$$

- Acceleration

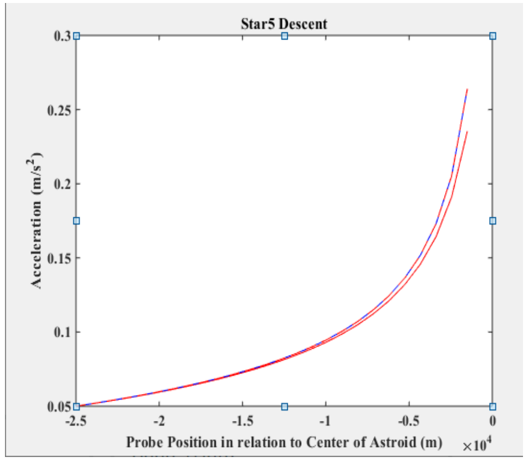
$$a = \frac{G m_2}{R^2} = \frac{dv}{dt}$$

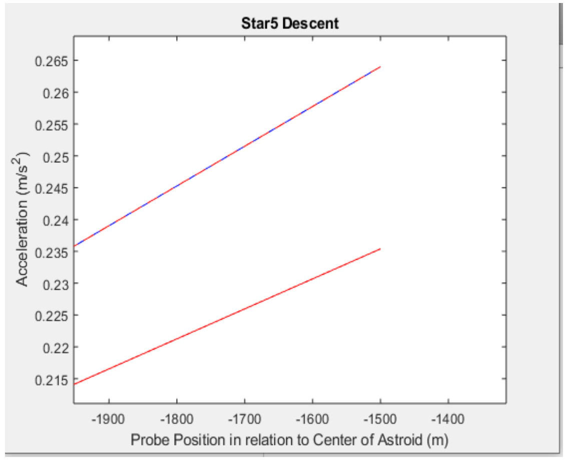
- Counter-force

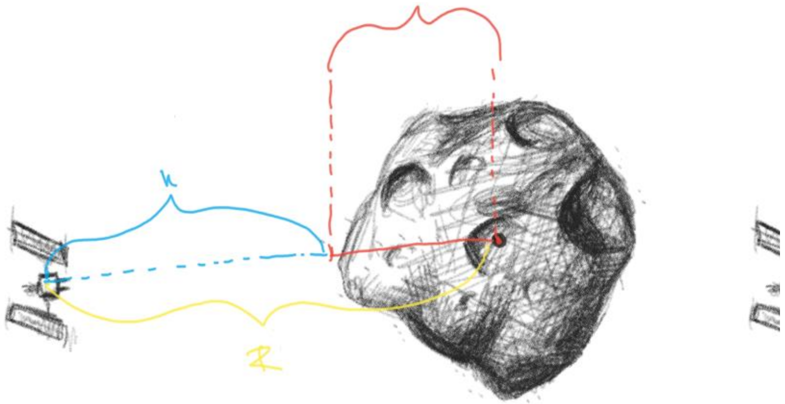
$$a_1 - a_2 = a_{final}$$

- Landing on a Spring

$$F_N = -k\Delta x = m_1 a_{final}$$







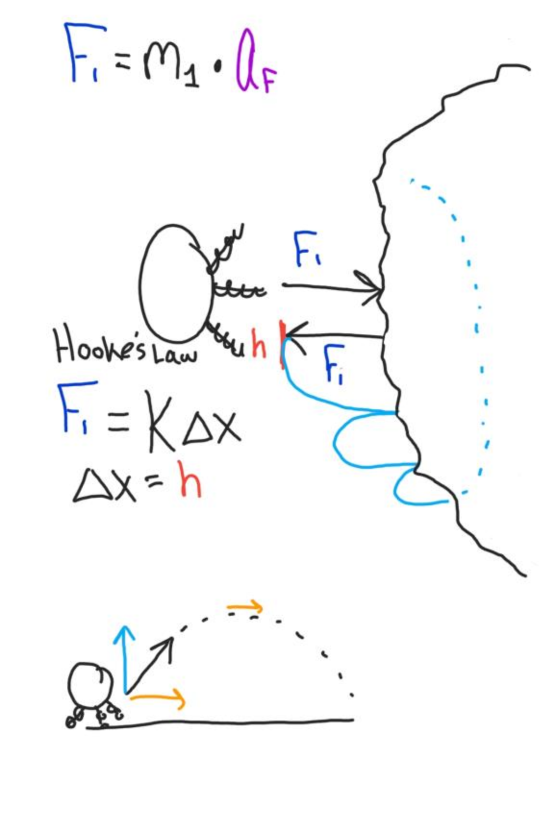
MOVING FROM POINT A TO POINT B

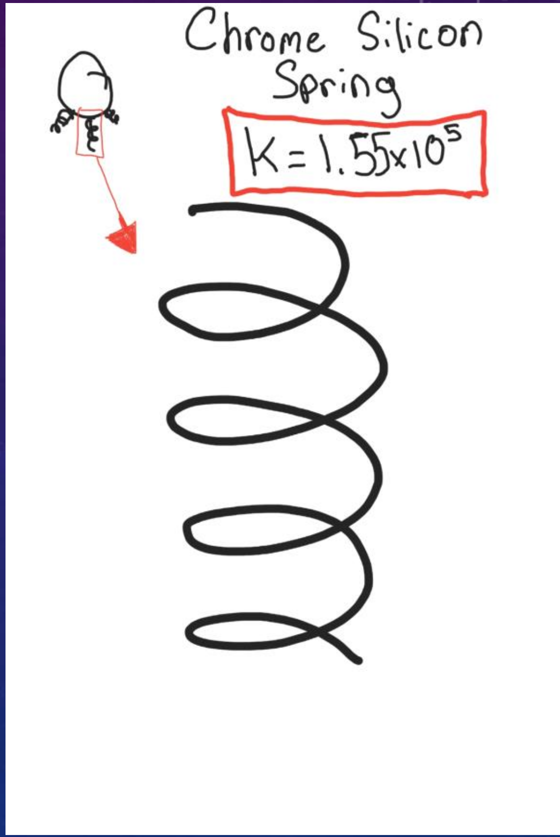
- In order to move from point A to Point B we must not exceed to Exit Velocity.

$$v_o < v_{exit} \Rightarrow v_o = \sqrt{2ar}$$

- We can calculate the maximum force that can be exerted vertically with Hooke's Law.

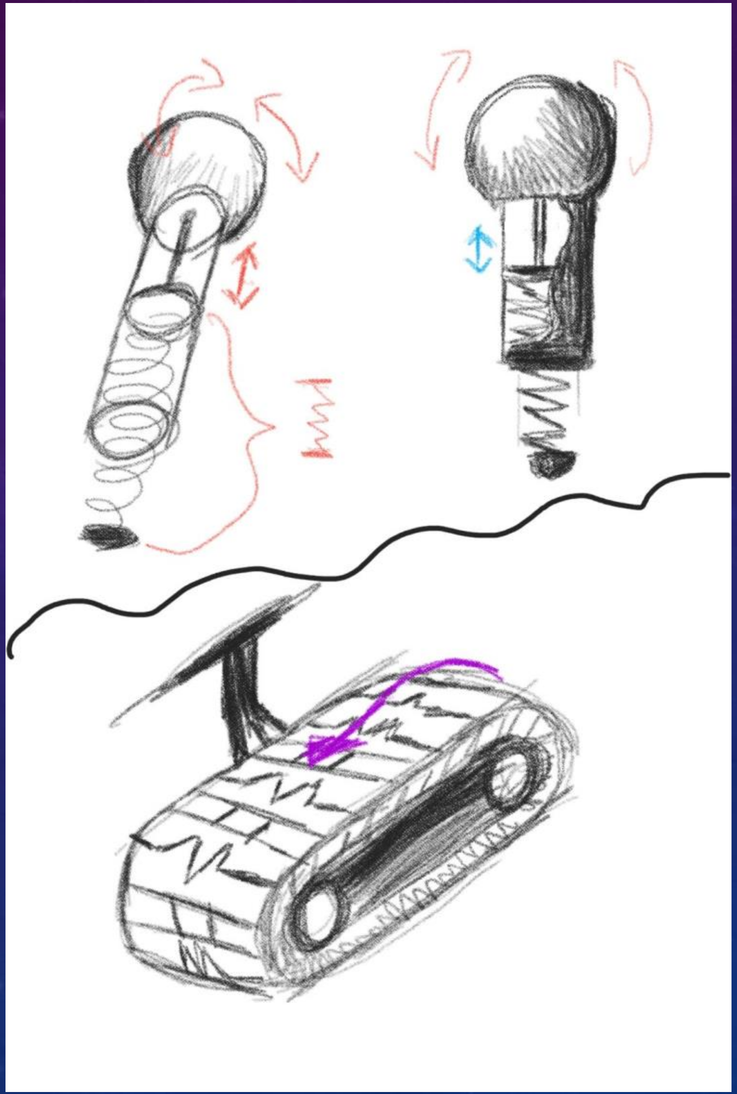
$$F = -kx = ma \rightarrow a = \frac{v^2}{2r} = \frac{dv}{dt}$$





ALTERNATIVE METHOD OF TRAVEL

- Consider if we had not one, but two efficient ways of travel.
- If we add the limitation of requiring our probe to also be able to roll on the asteroid as well as its original hopping design, we'd be able to obtain even more grip and traction.
- Original Design: Spherical Pivot Points Controlling the springs directions and compression.
- Updated Design: Spherical Pivot points controlling chamber and retractable springs



- At any point that hopping is not the most efficient method of transport, we will retract the springs, allowing our tread-wheel structure to take over.
- We received inspiration from the current designs of the Mars rover, which has a similar rough terrain of our presumed asteroid
- Our aluminum mesh treads have spokes to provide greater grip and mobility for our unpredictable environment.

ANALYSIS AND CONCLUSION

Knowing the mass of the Asteroid we can determine the counterforce needed to minimize bounce off the initial contact in a microgravity environment.

Axial Forces move independent of each other. Knowing this it is assumed that the probe will bounce in a calculated area dependent of the uneven terrain till it returns to equilibrium.

Through the use of Differential Equations we are able to determine all the necessary data needed to compete the Mission successfully with minimal error.

THANK YOU!

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