Analysis of the Bereshit Landing Simulation

The code is a simulation of the Bereshit lunar lander's descent and landing sequence, implemented in Java. Here's a breakdown of the key components:

Main Components:

1. **Main Class**: The entry point that initializes the simulation with starting parameters and runs the landing sequence.
2. **Moon Class**: Contains physical constants about the moon (radius, gravity) and calculates effective gravitational acceleration based on horizontal speed.
3. **PIDController Class**: Implements a Proportional-Integral-Derivative controller used to adjust thrust and angle during descent.
4. **Bereshit_101 Class**: Contains all the spacecraft parameters and the main landing logic.

Key Simulation Parameters:

- Initial vertical speed (vs): 24.8 m/s
- Initial horizontal speed (hs): 932 m/s
- Initial distance to landing site: 181,000 m
- Initial altitude: 13,748 m
- Initial angle: 58.3 degrees
- Initial fuel: 121 liters
- Total weight: 165.0kg + fuel

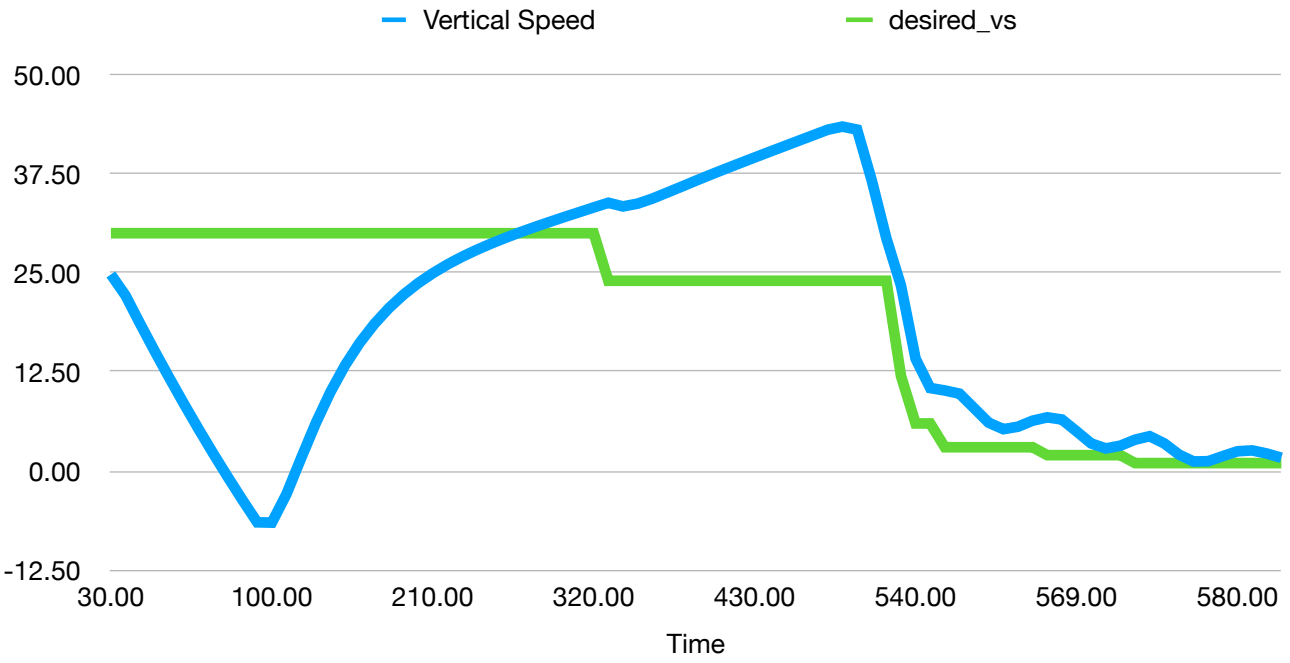
Additional Information: Materials and Crash of Beresheet

Materials Used in Beresheet Lander:

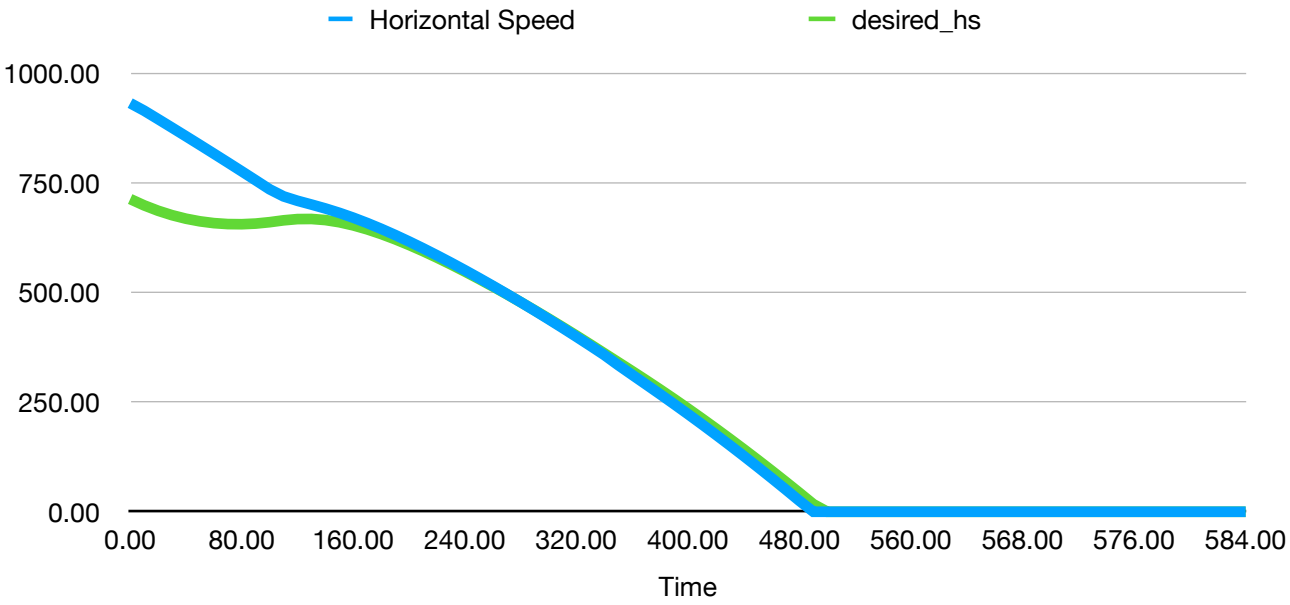
- The Beresheet lander was constructed primarily using lightweight aluminum alloys to minimize weight while maintaining structural integrity.
- Some internal components and electronics were housed in carbon fiber structures and other composite materials.
- Thermal insulation and shielding used Kapton and multi-layer insulation (MLI) to protect systems from lunar temperature extremes.

Crash of the Beresheet Lander:

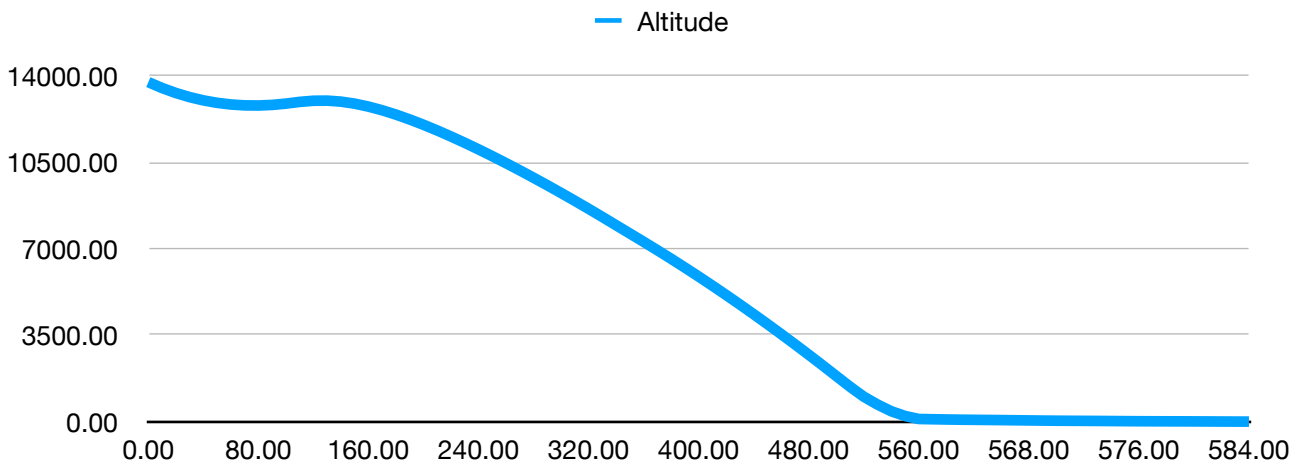
- On April 11, 2019, Beresheet attempted a soft landing on the Moon.
- During the final descent, a gyroscope failure triggered a cascade of events, including a premature shutdown of the main engine.
- Efforts to restart the engine were partially successful, but by then, the lander had descended too rapidly.
- The spacecraft crashed into the Moon’s surface at high speed.
- Despite the crash, the mission was considered a major technological achievement, marking Israel as the seventh nation to orbit the Moon.



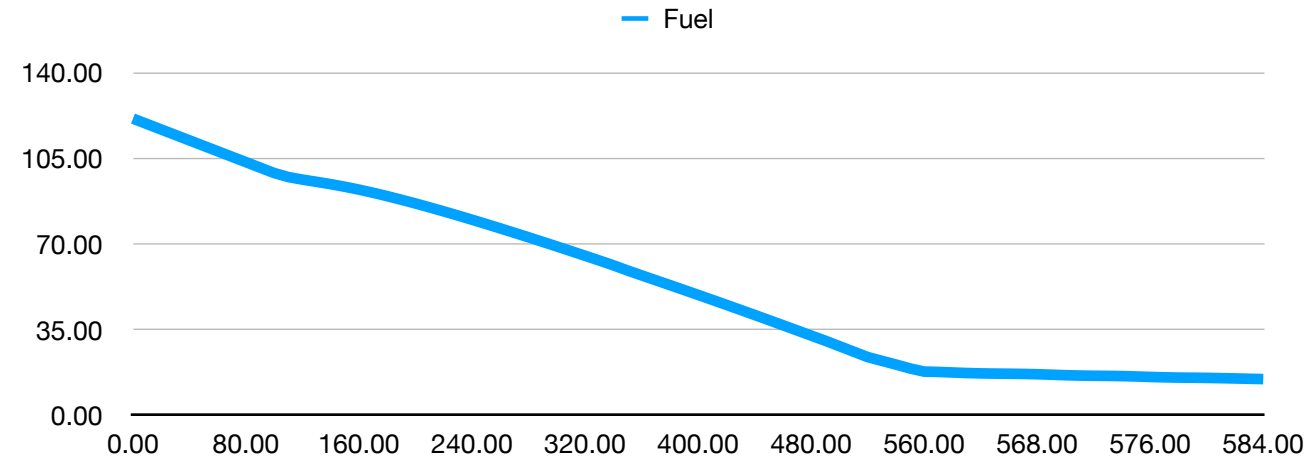
Vertical Speed:
Shows how the vertical speed of the lander changed over time. A sharp drop near the end indicates deceleration before impact.



Horizontal Speed:
Displays the decrease in horizontal speed as the lander slowed down during descent to align with the desired trajectory.



Altitude:
Altitude steadily decreases, showing the lander's descent toward the surface.



Fuel:
Fuel consumption increases over time as thrusters fire to control descent and speed.