Survival of the Fittest: Using Biological Concepts to Maximize Efficiency

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As new space technologies are developed, it is pertinent that efficiency is taken into consideration during their conception. In order to determine conditions needed to reduce fuel consumption and error during aerospace transfers, I developed and tested a genetic algorithm. After developing a genetic algorithm, it was run in tandem with a Lambert Targeter, which determines the change in velocity a spacecraft would need to intercept a given target. My algorithm determined the time of transfer between the spacecraft and it’s target that would result in minimal change in velocity, or minimal fuel consumption. The algorithm determined that a time of 19,082 seconds would produce the minimal change in velocity at 22.15km/s. The known time for this transfer produced by the Hohmann Transfer calculation was only sixty seconds less than the value produced by the algorithm. The algorithm was then applied to the Three Body Problem, finding the angle and time of transfer needed to get a spacecraft from the Earth to the Moon autonomously with minimal error. It was determined that if the spacecraft had an angle of 130 degrees and completed the transfer at its maximum velocity, the closest it could get to the moon with no human intervention is .2142 kilometers away. The initial conditions produced by the algorithm would allow for minimized error during autonomous space travel. For both Lambert Targeting and the Three Body Problem, my genetic algorithm provided initial conditions that would produce efficient transfers. To verify my results, I tested each possible combination of initial conditions the algorithm could encounter. In the future, my algorithm could be applied to additional aerospace problems in order to provide further suggestions for the improvement of space travel.