Analysis of the Method of Compressed Air Propulsion and Its Application to Model Rockets

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The aim of this project is to optimize thrust generated by compressed air propulsion for model rockets to increase maximal altitude inflight and to determine the parameters leading to a safe landing. To achieve this goal, equations describing how the pressure inside the pressure tank of a rocket evolves over time were derived. Experiments with a pressure tank were conducted afterwards to test the reliability of these equations. Finally, the equations were implemented in computer simulations which provided altitude optimizations as well as determination of the landing parameters. As a result of these experiments, a correction factor was introduced in the equations to compensate for the error of the mathematical prediction caused by the friction at the nozzle of the pressure tank. A first simulation showed that increasing the volume of the pressure tank above a certain value has a negative effect on the maximal altitude. This can be explained by the additional mass of a bigger pressure tank outweighing the additional thrust. The second simulation led to a successful determination of the landing parameters. To conclude, more effective model rockets can be built by using the simulations developed throughout this project. However, the results obtained are not only useful for model rocketry but provide tools for any kind of application relying on pressure tanks, as well.

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