Powered swing-bys to perform orbital maneuvers

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This paper studies the problem of applying an impulsive thrust in a spacecraft that is performing a Swing-By maneuver (also called Gravity Assisted maneuver). The objective is to derive a set of analytical equations that can calculate the change in velocity, energy and angular momentum for this maneuver as a function of the three usual parameters of the standard Swing-By maneuver plus the two parameters (the magnitude of the impulse and the angle between the impulse and the velocity of the spacecraft) that specify the impulse applied. The dynamics used to obtain those equations is the one given by the "patched-conic" approach. A study is also performed to find in which cases the impulse is more efficient when applied during that close approach or after that, in a two steps maneuver. After that, the same maneuvers are computed under the dynamics given by the restricted three-body problem and the results are compared with the ones obtained previously under the "patched-conic" dynamics.