Mission Design for Deflecting Earth-Crossing Asteroids/Comets

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Using a nonlinear programming, a detailed optimization problem is formulated to calculate optimal impulses for deflecting Earth-crossing asteroids/comets. The constrained optimization problem is based on a three-dimensional patched conic method to include the Earth's gravitational effects and asteroid/comet's orbital inclination effects. The magnitudes and impulse angles of optimal delta-V are accurately computed at various points on the asteroid/comet' s orbit to provide a given target separation distance. Interceptor mass (or energy) is also estimated for various deflection strategies such as high-thrust engine, kinetic deflection, nuclear detonation, and laser ablation. The potential ability of each mitigation scheme, in conjunction with several future spacecraft concepts, is also described.