Abstract
This paper introduces a new set of compatible orbits called “Two-Way Orbits,” whose ground track path is a closed-loop trajectory that intersects at certain points with tangent intersections. The spacecraft passes over these tangent intersections once in a prograde mode and once in a retrograde mode. Motivations are found for the need to have simultaneous observations of the same target area in both Earth observation and reconnaissance systems. The general mathematical model to design a Two-Way Orbit is presented for the specific case where the tangent points are experienced at the orbit extremes, perigee and apogee. As for the general case, Two-Way Orbit conditions are formulated and numerically solved. Results show that, in general, Two-Way Orbits could be formed over any point on Earth. Since Two-Way Orbits use compatible orbits, the theory of Flower Constellations can be applied to them. Using these Two-Way Orbits, this paper also introduces the Two-Way Flower Constellations that have one spacecraft prograde and one retrograde passing simultaneously over the tangent intersection.