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Deployment Considerations for Spacecraft Formation at Sun-Earth L2 Point

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Abstract: The coordination and control of a constellation of spacecraft, flying a few meters from one another, dictates several interesting design requirements, including efficient architectures and algorithms for formation acquisition, reorientation and resizing. The spacecraft must perform these transitions without interfering or colliding into each other. Furthermore position keeping is fundamental for formation efficiency. This paper presents an optimal deployment of the DARWIN formation using the potential function control technique in the vicinity of the Sun-Earth L2 point. The method hinges on defining a potential function from the geometric configuration of the constellation together with any collision avoidance requirement. A review of the fundamentals of relative motion and dynamics is presented before describing the features of the different control algorithms and validating the method using Lyapunov's theorem. The potential function method has been used to control both translational and rotational control. Obstacles, in the shape of other satellites and constrained payload pointing directions have been included. Finally it will be shown that the attitude control algorithm can be successfully used to avoid plume impingement that can have catastrophic consequences for the mission.

Keywords: *Formation flying; Lyapunov functions; rotational control.*

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