The state equation of the formation control system is one of first-order integrator

or collectively,

where the state is the position vector of the -th robot, and the control is the velocity vector of the -th robot.

**Control objective**: the group of robots attempt track a prescribed trajectory

or collectively,

where is a first-order differentiable function. In the meantime, the group of robots attempt to maintain a time-invariant formation as specified by

**Proposed controller**:

where is the set of indices of the 1-hop neighbors of the -th robot.

**Proof**:

Let be the tracking error. The error system can be written as

The controller for the error system is

To prove that the above control objective is satisfied by applying the above controller to the original system, we only need to equivalently prove that the error system is asymptotically stable at the origin when the above is applied.

Let the Lyapunov function be . Its derivative is