Estimator properties:
- Exactness
- Initialization robustness
- Time-invariance
- Internal stability
- Fast convergence
- Local broadcast communication

Cons: Cannot track signals whose average is unbounded.


Cons: The estimator is not internally stable.

References: Spanos et al. (2005), Zhu & Martinez (2010)

Cons: The current output is a function of the current states of neighboring agents, and the estimator is not internally stable.

References: The estimator cannot track time-varying signals.

To make the estimator robust to the initial condition, the Laplacian is moved after the integrator. The initial states decay in the disagreement directions and no longer appear in the output in the consensus direction.

Cons: The current output is a function of the current states of neighboring agents, and the estimator is not internally stable.

References: The estimator is not internally stable.

Cons: Cannot track signals whose average is unbounded.

References: The estimator cannot track time-varying signals.

To make the estimator internally stable, the state space is changed from the plane to the cylinder. The integrator states, which were previously unbounded, now live on the torus $T^n$ and are inherently bounded. To do this, the nonlinear Laplacian, defined as $\mathcal{L}(\cdot) = BW f(B^T \cdot)$, is used where $f$ is the phase coupling function and $f = 1$ corresponds to the linear case, and the projection map $\Pi$ replaces the identity matrix.

Cons: Cannot track signals whose average is unbounded.

References: The estimator is not internally stable.