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**Network-theoretic approach to model vortex interactions**[1]
ADITYA NAIR, KUNIHIKO TAIRA, Florida State University — We present a network-theoretic approach to describe a system of point vortices in two-dimensional flow. By considering the point vortices as nodes, a complete graph is constructed with edges connecting each vortex to every other vortex. The interactions between the vortices are captured by the graph edge weights. We employ sparsification techniques on these graph representations based on spectral theory to construct sparsified models of the overall vortical interactions. The edge weights are redistributed through spectral sparsification of the graph such that the sum of the interactions associated with each vortex is maintained constant. In addition, sparse configurations maintain similar spectral properties as the original setup. Through the reduction in the number of interactions, key vortex interactions can be highlighted. Identification of vortex structures based on graph sparsification is demonstrated with an example of clusters of point vortices. We also evaluate the computational performance of sparsification for large collection of point vortices.

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