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Predicting the growth of fractal particle agglomeration networks with graph theoretical methods.[1]

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We study an electromechanical system [J. Jun, A. Hubler, *PNAS* **102**, 536 (2005); J. Jun, Ph.D. thesis, UIUC (2004)], where conducting particles self-organize into dendritic patterns under the influence of an electric field for the purpose of collecting and transporting charge. The system forms stable open-loop networks with many reproducible statistical quantities, such as the number of termini and the number of branch points, but the final topology of the network is sensitive to the initial conditions of the particles. Small differences in the initial configuration may lead to very different stationary states. We present robust and reliable ensemble prediction algorithms for the growth of such fractal charge transportation networks. These predictors may lead to the discovery of common properties and serve a prototype to predict fractal growth in other areas, including neural systems; blood vessel systems, river networks, and dielectric break through.

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