ITERATED CONFORMAL MAPPING APPROACH TO MULTIPLE-CLUSTER DIFFUSION LIMITED AGGREGATION, R. Ciaravino, D. Crowdy*, Massachusetts Institute of Technology, Department of Mathematics, Cambridge, MA, 02215, crowdy@math.mit.edu

The Diffusion Limited Aggregation (DLA) model, proposed by Witten and Sander in 1981 [1], models the stochastic growth in a Laplacian diffusive field. The fractal growth models various natural processes including biological morphologies, physiochemical processes, and dielectric breakdown, and since has been a research area of great interest. In recent years, Hastings and Levitov [2] introduced an iterated conformal mapping technique, which makes use of the property of conformal invariance of the Laplacian field to model DLA.

Because in practice, the particle aggregation occurs not only at isolated sites, it is of interest to model the simultaneous growth of DLA at multiple growth sites. It is experimentally known that distinct DLA clusters (sites) do not join each other, and in fact multi-cluster DLA results in a repulsion line between clusters.

We have investigated the generalization of the Hastings-Levitov technique to that of multi-cluster DLA. While an exact modeling of simultaneous growth sites using such technique is hindered by the domains of definition of the conformal mappings, we in fact propose a new model still using the conformal mapping technique that approximates the growth of multi-cluster DLA. In DLA, the probability of a new particle growth along a particular segment of the cluster boundary is governed by the surrounding Laplacian field. Using conformal transformations, we show that the probability measure for the configuration of any arbitrary multi-cluster array is determined by a fixed number of parameters. Thus, with some approximations, namely approximating each cluster with an “effective circular cluster,” we are able to approximate the probability measure. In this simulation, each individual cluster is grown using the Hastings-Levitov iterated conformal mappings, yet its growth nonetheless is determined by the structure of all clusters.

Thus, our resulting model simulates the growth for multi-cluster DLA, in which the distinct clusters exhibit the appropriate fractal growth behavior, including repulsion from other clusters.

As the first model of multi-cluster DLA using the conformal mapping technique, we introduce an efficient and effective method of growing approximate multi-cluster DLA. Furthermore, the methods of approximation can be modified for an even larger range of use.

[1] T.A. Witten & L.M. Sander, Diffusion-limited aggregation, a kinetic critical phenomenon, *Phys. Rev. Lett.,* **47**, 1400, (1981).

[2] M.B. Hastings & L.S. Levitov, Laplacian growth as one-dimensional turbulence, *Physica D,* **155**, 244, (1998).