Influence of defect between closely placed disks on their capacity

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We study influence of defect between closely placed disks on their capacity. The capacity $C(D)$ is defined as minimal value of Dirichlet integral

$$C(D) = \min \int_D |\nabla \phi(x, y)| dxdy,\ \phi \in H_2^1(D),$$

over domain $D = R^2 \setminus D_1 \setminus D_2 \setminus D$. where D_1, D_2 are two closely placed disks, D is a domain between the discs (the model of defect).
We demonstrate that $C(D)$ monotonically decreases when D monotonically increases in the sense of domains inclusion.
Additional information may be obtained from the numerical experiments. Our experiments shows that the capacity $C(D)$ strongly depend on the length of the defect in the direction normal line connecting the centers of the disks and slow depends on the thickness of the defect.
This result may be used to develop network models for high contrast densely packing particles imbedding into matrix with defects [1].

References

1. Berlyand L., Kolpakov A.G., Novikov A. Introduction to the Network Approximation Method for Materials Modeling. Cambridge University Press, Cambridge (2013).