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Dispersed Multiphase Flow Generation using 3D Steerable Convolutional Neural Network[1] BHARGAV SRIRAM SIDDANI, S. BALACHANDAR, RUOGU FANG, WILLIAM CHANDLER MOORE, YUNCHAO YANG, University of Florida — This work deals with recreating particle-resolved fluid flow around a random distribution of particles in a dispersed multiphase setup using Convolutional Neural Networks (**CNN**s). The considered problem is rotationally invariant about the mean velocity (streamwise) direction. Thus, the objective of our work is to enforce this symmetry using **SE(3)-equivariant** CNN architecture, which is translation and three-dimensional rotation equivariant. This study mainly explores the generalization capabilities of SE(3)-equivariant network when it is used in conjunction with physics-based loss terms. Synthetic flow fields that are 75-95% accurate are produced for Reynolds number and particle volume fraction combinations spanning over a range of [2.69, 172.96] and [0.11, 0.45] respectively with careful application of physics-constrained data-driven approach, whose computational cost is more than four orders of magnitude lower compared to an equivalent CFD approach.

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