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Dynamic structural network evolution in compressed granular systems. LIA PAPADOPOULOS, University of Pennsylvania, JAMES PUCKETT, Gettysburg College, KAREN DANIELS, North Carolina State University, DANIELLE BASSETT, University of Pennsylvania — The heterogeneous dynamic behavior of granular packings under shear or compression is not well-understood. In this study, we use novel techniques from network science to investigate the structural evolution that occurs in compressed granular systems. Specifically, we treat particles as network nodes, and pressure-dependent forces between particles as layer-specific network edges. Then, we use a generalization of community detection methods to multilayer networks, and develop quantitative measures that characterize changes in the architecture of the force network as a function of pressure. We observe that branchlike domains reminiscent of force chains evolve differentially as pressure is applied: topological characteristics of these domains at rest predict their coalescence or dispersion under pressure. Our methods allow us to study the dynamics of mesoscale structure in granular systems, and provide a direct way to compare data from systems under different external conditions or with different physical makeup.

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