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Linear and nonlinear response in sheared soft spheres BRIAN TIGHE, Delft University of Technology — Packings of soft spheres provide an idealized model of foams, emulsions, and grains, while also serving as the canonical example of a system undergoing a jamming transition. Packings' mechanical response has now been studied exhaustively in the context of "strict linear response," i.e. by linearizing about a stable static packing and solving the resulting equations of motion. Both because the system is close to a critical point and because the soft sphere pair potential is non-analytic at the point of contact, it is reasonable to ask under what circumstances strict linear response provides a good approximation to the actual response. We simulate sheared soft sphere packings close to jamming and identify two distinct strain scales: (i) the scale on which strict linear response fails, coinciding with a topological change in the packing's contact network; and (ii) the scale on which linear superposition of the averaged stress-strain curve breaks down. This latter scale provides a "weak linear response" criterion and is likely to be more experimentally relevant.

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