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Coupled Oscillator Model for Nonlinear Gravitational Perturbations HUAN YANG, Perimeter Institute for Theoretical Physics, FAN ZHANG, Beijing Normal University, STEPHEN GREEN, LUIS LEHNER, Perimeter Institute for Theoretical Physics — Motivated by the fluid/gravity correspondence, we introduce a new method for characterizing nonlinear gravitational interactions. Namely we map the nonlinear perturbative form of the Einstein's equation to the equations of motion of a series of nonlinearly-coupled harmonic oscillators. These oscillators correspond to the quasinormal modes of the background spacetime. We demonstrate the mechanics and the utility of this formalism with an asymptotically AdS black-brane spacetime, where the equations of motion for the oscillators are shown to be equivalent to the Navier-Stokes equation for the boundary fluid in the mode-expansion picture. We thereby expand on the explicit correspondence connecting the fluid and gravity sides for this particular physical set-up. Perhaps more importantly, we expect this formalism to remain valid in more general spacetimes, including those without a fluid/gravity correspondence. In other words, although born out of the correspondence, the formalism survives independently of it and has a much wider range of applicability.

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