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The averaging problem in Szekeres dust models

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We consider a general formalism of scalar averaging for the study of the dynamics of Szekeres dust models. Although these models do not admit (in general) Killing vectors, their averaged scalars behave as spherically symmetric quantities. We show that under a suitable choice of an invariant weight factor the averaged scalars identically satisfy FLRW dynamics, so that inhomogeneity becomes encoded in their fluctuations. The evolution equations for these averaged scalars and their fluctuations leads to a fully consistent and complete 3-dimensional dynamical system that can be studied with standard techniques. These evolution equations lack the "back-reaction" terms that characterize Buchert's formalism (the average with unit weight factor), and lead in a natural way to define a rigorous perturbation formalism. The main curvature and kinematic invariant scalars are directly related to the variance and covariance momenta constructed with the fluctuations, which leads to a potentially useful and invariant definition of gravitational entropy.