MIGRATION

PRESTACK SHOTPOINT AND COMMON MIDPOINT MIGRATION
USING THE SPLIT-STEP FOURIER ALGORITHM (P-39)

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Plane-wave decomposed seismic data can be migrated using a phase-shift method that
accommodates lateral variation in slowness (reciprocal of velocity). The split-step
Fourier method is a perturbation technique that decomposes the slowness function into a
mean and its lateral variation for each depth interval being migrated. For each depth step,
a phase shift is applied in the wavenumber–frequency domain based on a reference
horizontal ray parameter and the mean slowness of the interval. Local phase perturbations
that accommodate the lateral variability of the slowness field and the true horizontal ray
parameter are applied after a Fourier transform to the spatial domain. The method is
developed for τ-p transformed shotpoint and common midpoint data. In the shotpoint
case, the spatial coordinate of reference is the shot position along the survey line. For
common midpoint data, the reference is the midpoint position. After each migration
interval, the reference CMP or receiver ray parameter must be modified because of the
local slowness perturbations. For either geometry, the perturbation in the horizontal ray
parameter, due to the small variations in an otherwise laterally homogeneous model, are
calculated rapidly using perturbation theory without the need for ray tracing. Although
the theory assumes small lateral variation, the method has been used in imaging realistic
geological structures for both shotpoint and common-midpoint data.

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