An analyte zone migrating through a chromatographic bed is dispersed in longitudinal and transverse directions (parallel and perpendicular, respectively, with respect to the macroscopic flow direction) by a combination of diffusive and convective processes. When a streamlet of the mobile phase hits a solid obstacle, e.g., a support particle of the chromatographic bed, it splits into several, unequal streamlets which flow around the obstacle and merge with other streamlets coming from neighboring obstacles. Convective dispersion in transverse direction in a particulate bed is caused by this stream splitting mechanism, whereas longitudinal dispersion originates in the point-to-point differences of the flow velocity that exist over the column cross section. The flow pattern of a fluid undergoing laminar flow in a particulate bed depends on the morphology (i.e., the topology and geometry) of the pore space available for the flow so that the inherent structural heterogeneity of the packed bed sensitively influences time and length scales which characterize velocity fluctuations in the mobile phase.