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Stability of Miscible Displacements in Porous Media for Time-Dependent Injection Velocities[1] QINGWANG YUAN, JALEL AZAIEZ, Department of Chemical and Petroleum Engineering, University of Calgary — Flow instabilities are often observed when a high-viscosity fluid is displaced by a low-viscosity fluid in porous media. Even though most existing studies have analyzed such instabilities in the case of constant injection velocity, in many practical processes such as ground water flows and enhanced oil recovery, the velocity is actually time dependent. This work presents linear stability analysis of miscible displacement with time-dependent injection velocities in rectilinear Hele-Shaw cell. Both quasi-steady-state approximation (QSSA) and initial value calculation (IVC) methods are used to analyze the stability of constant, sinusoidal, and step injection velocity models. For QSSA, it is found that the growth rate follows the behavior of the injection velocity, while it also tends to flatten out whenever the contribution to the velocity is negative. For such negative velocities, the inverse displacement is unconditionally stable. For IVC, the variation of growth rate is influenced by velocity amplitude Γ and time. The growth rates at maximum and minimum velocities are nearly the same as their constant velocity counterparts when Γ is small. For large Γ, they are different, with some special characteristics.

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