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To simulate the no-slope-selection epitaxial thin film growth numerically, we construct a numerical method for the growth equation by combining the linear convex splitting with the second-order strong-stability-preserving implicit-explicit Runge-Kutta method. As a result, the method is linear, accurate, and unconditionally energy stable. Using the method, we perform the long time simulation for the coarsening process, where the  $-\ln(t)$  energy decay and  $t^{1/2}$  roughness growth rates can be observed clearly.