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Unified mathematical model for linear viscoelastic predictions of linear monodisperse and polydisperse and branched polymers. RENAT KHALIULLIN, JAY SCHIEBER — We present an application of a single-chain mean-field model for entangled linear blends and star-branched systems. Slip-links instead of tubes are employed. The entanglements on a chain are destroyed by two coupled relaxation processes: so-called sliding dynamics; and relaxation of the environment, so-called constraint dynamics. The constraint dynamics are implemented by destruction and creation of the entanglements in the middle of the chain in a way statistically self consistent with sliding dynamics. In contrast to previous tube models, Rouse dynamics is completely avoided. Nonetheless, the implementation of constraint dynamics in tube models is different for linear and branched chains; the slip-link model shows no need for modification of constraint dynamics. Moreover, our slip-link model requires a single fitting parameter τ_{K} that depends on the temperature of the melt, but not on chain length. The parameter can be fixed from a single fit to linear viscoelastic data. In addition, for branched polymers the branch point movements are determined by the free energy, so that its position is allowed to fluctuation, and even slide through the slip-links. The resulting model exhibits primitive-path fluctuations and chain stretching, so could be applied to flow and generalized to more complicated branches or cross-linked networks without significant modifications.

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