Generalization of the Friction Theory for Viscosity Modeling

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In this work, a recent generalization of the friction theory (FT) approach for viscosity modeling is presented. In several previous works, the FT approach has been shown to be applicable to a large number of systems. However, a former major limitation of the FT approach has been the requirement of using a van der Waals type equation of state (EoS) already built on a balance between an attractive and a repulsive term. Therefore, in order to circumvent this limitation, in this work a pragmatic generalized definition for the required repulsive and attractive pressure terms is presented and its application illustrated. This proposed definition is based on the internal pressure concept and, although it has some conceptual limitations, it is shown to work even in such an extreme case as water. As a result, the FT can be extended to practically all types of EoS, from theoretical ones, such as those based on thermostatistical or renormalization theories, to even the highly accurate empirical reference EoS. Furthermore, in addition to integrating accurate viscosity models with a reference or theoretical EoS, it is also observed that some important physicochemical phenomena, such as an apparent critical anomaly, appear to naturally follow from the physics already built into the EoS.