Square-well fluids

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The simplest model for a fluid is the many-body system with the square-well interactions. In the limit of infinite range vanishing attraction one can get well-known van der Waals equation of state. This equation predicts critical point and liquid-gas transition. The investigation of critical properties of the system with finite-range interaction is more complicated. For three-dimensional systems the dependence of the critical density and critical temperature were studied using virial expansion truncated to the third order. The analytical results are compared with numerical simulations. It was shown that the temperature dependence of the critical density is non-monotone, this result is confirmed by the exact analytical result for one-dimensional systems. Compressibility maps are analyzed and stability problems are discussed.