Theory of liquids and polymers disordered systems

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Outline

1. Structure of liquids
    - Molecular distribution functions and models
    - Scattering theory
    - Theories for the two-point correlation function
    - Relation between structure and thermodynamics
    - Random-phase approximation
2. Liquid dynamics
    - Time-dependent correlation functions
    - Linear response theory
    - Mori-Zwanzig projection formalism
    - Linear hydrodynamics
    - Generalized hydrodynamics
    - Mode-coupling theory
    - Glass transition
3. Random walks and fractals
    - Random walk and diffusion
    - Master equation
    - Fractals and fractal dimension
    - Percolation
    - Random walk on a fractal
    - Diffusion-limited aggregation
4. Structure and thermodynamics of binary mixtures (solutions)
    - Partial correlation functions
    - Number- and concentration fluctuations
    - Random-phase approximation and Flory-Huggins theory of solutions and phase segregation
    - solutions of polymers
5. Structure and thermodynamics of polymers
    - single ideal polymer chain and random walk
    - Flory theory of self-avoiding chains and swollen polymers
    - Path-integral theory of polymer structure
    - Polymer mixtures and diblock copolymers
    - Cross-linked polymers: Flory-Stockmayer theory of gelation
6. Polymer dynamics
    - Rouse dynamics
    - Incoherent relaxation dynamics
    - Hydrodynamic interaction
    - Zimm model
    - Polymer diffusion

References

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