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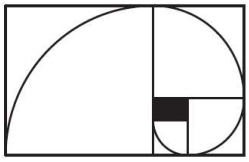

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Cluster expansions, trees, inversions and correlations

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Abstract. We review some recent progress on applications of Cluster Expansions. We focus on a system of classical particles living in a continuous medium and interacting via a stable and tempered pair potential. We review the cluster expansion in both the canonical and the grand canonical ensemble and compute thermodynamic quantities such as the pressure, the free energy as well as various correlation functions. We derive the equation of state either by performing inversion of the density-activity series or directly in the canonical ensemble. Further applications to the liquid state expansions and the relevant closures are discussed, in particular their convergence in the gas regime.

Keywords. Cluster and virial expansions, combinatorial species, generating functions, inversion theorem, trees, correlation functions, liquid state expansions.

2020 Mathematics Subject Classification: 82B05, 82D15, 82D30, 05A15, 05C05.

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