# A theory of solving TAP equations for Ising models with general invariant random matrices - DTU Orbit (08/11/2017)

## A theory of solving TAP equations for Ising models with general invariant random matrices

We consider the problem of solving TAP mean field equations by iteration for Ising models with coupling matrices that are drawn at random from general invariant ensembles. We develop an analysis of iterative algorithms using a dynamical functional approach that in the thermodynamic limit yields an effective dynamics of a single variable trajectory. Our main novel contribution is the expression for the implicit memory term of the dynamics for general invariant ensembles. By subtracting these terms, that depend on magnetizations at previous time steps, the implicit memory terms cancel making the iteration dependent on a Gaussian distributed field only. The TAP magnetizations are stable fixed points if a de Almeida–Thouless stability criterion is fulfilled. We illustrate our method explicitly for coupling matrices drawn from the random orthogonal ensemble.

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