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Analytic and Numerical Bootstrap for One-Matrix Model and "Unsolvable" Two-Matrix Model

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We propose the relaxation bootstrap method for the numerical solution of multi-matrix models in the large N limit, developing and improving the recent proposal of H.Lin. It gives rigorous inequalities on the single trace moments of the matrices up to a given "cutoff" order (length) of the moments. The method combines usual loop equations on the moments and the positivity constraint on the correlation matrix of the moments. We have a rigorous proof of applicability of this method in the case of the one-matrix model where the condition of positivity of the saddle point solution appears to be equivalent to the presence of supports of the eigenvalue distribution only on the real axis and only with positive weight. We demonstrate the numerical efficiency of our method by solving the analytically "unsolvable" two-matrix model with tr[A,B]2 interaction and quartic potentials, even for solutions with spontaneously broken discrete symmetry. The region of values for computed moments allowed by inequalities quickly shrinks with the increase of the cutoff, allowing the precision of about 6 digits for generic values of couplings in the case of Z2 symmetric solutions. Our numerical data are checked against the known analytic results for particular values of parameters.

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