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On the applicability of bosonization and the Anderson-Yuval methods at the strong-coupling limit of quantum impurity problems

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The applicability of bosonization and the Anderson-Yuval (AY) approach at strong coupling is investigated by considering two generic impurity models: the multichannel interacting resonant-level and anisotropic Kondo models. The two methods differ in the renormalization of the conduction-electron density of states (DoS) near the impurity site. Reduction of the DoS, absent in bosonization but accounted for in the AY approach, is shown to be vital in some models yet redundant in others. The criterion being the stability of the strong-coupling fixed point. Renormalization of the DoS is essential for an unstable fixed point, but redundant when a decoupled entity with local dynamics is formed. This rule can be used to greatly enhance the accuracy of both methods at strong coupling.