GENERALISED HEINE-STIELTJES AND VAN VLECK POLYNOMIALS ASSOCIATED WITH DEGENERATE, INTEGRABLE BCS MODELS

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We will present new results concerning numerical methods to study integrable systems based on the Bethe Ansatz/Ordinary Differential Equation (BA/ODE) correspondence. We will discuss how this approach can be applied to four cases of exactly solvable Bardeen-Cooper-Schrieffer (BCS) pairing models in their degenerate two-level limit. These are the s-wave pairing model, the $p+ip$-wave pairing model, the $p+ip$ pairing model coupled to a bosonic molecular pair degree of freedom, and a $d+id$-wave pairing model with additional interactions. The zeros of the generalised Heine-Stieltjes polynomials provide solutions of the corresponding Bethe ansatz equations. We compare the roots of the ground states with curves obtained in the continuum limit.