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## Bilinear forms and soliton solutions to partial difference equations

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### Abstract

We construct multisoliton solutions to the low members of the Adler–Bobenko–Suris list of difference equations (H1,H2,H3,A1,Q1, see CMP **233**, 513 (2002)). The construction is done explicitly using Hirota’s direct method: First we construct, almost algorithmically, the background solution and the one-soliton solution. On the basis of this information we can propose a dependent variable transformation that converts the equation into Hirota’s bilinear form.  $N$ -soliton solutions are then constructed to the bilinear equations using Casorati determinants; there is a close association to the Hirota–Miwa equation. The approach and the solutions bear similarity to the Q3 case, which was derived earlier by Atkinson–Hietarinta–Nijhoff (J. Phys. A **41**, 142001 (2008)).

**Joint work with Da-jun Zhang.**