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Chirally coupled fermion-kink system, multi-frequency sine-Gordon and topological sectors

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A two-dimensional field theory which describes a fermion-kink system is studied. The analytical solutions of the system are obtained by using the tau function approach. We studied the relationships of the kink and the normalizable fermion bound states on the parameters of the model, which involve a fermion-scalar coupling and scalar field self-coupling. As submodels we uncover an integrable Toda model coupled to the fermion and the non-integrable double sine-Gordon model. It is shown that the backreaction of the localized fermions modifies appreciably the kink solutions, in particular, it shows the oscillation of the profile of the kink and violates the reflection symmetry of the configuration.

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