Geometric approach to domain wall solution

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Abstract Some generalizations of Landau-Lifschitz equation are integrable, admit physically interesting exact solutions and these integrable equations are solvable by the inverse scattering method. Investigating of the integrable spin equations in (1+1)-, (2+1)-dimensions are topical both from the mathematical and physical points of view. Integrable equations admit different kinds of physically interesting as domain wall solutions. We consider an integrable spin equation. There is a corresponding Lax representation. Moreover the equation allows an infinite number of integrals of motion. We construct a surface corresponding to domain wall solution of the equation. Further, we investigate some geometrical features of the surface.

1 Introduction

We use the geometric approach to one of the generalized Landau-Lipshitz equation [1]-[4]

$$\mathbf{S}_t = (\mathbf{S} \times \mathbf{S}_y + u\mathbf{S})_x, \tag{1a}$$

$$u_x = -(\mathbf{S}, (\mathbf{S}_x \times \mathbf{S}_y)), \tag{1b}$$

where $\mathbf{S}$ is spin vector, $S_1^2 + S_2^2 + S_3^2 = 1$, $\times$ is vector product, u is a scalar function. The equation allows an infinite number of motion integrals and has several exact solutions. One of them is the domain wall solution [3]. We identify the spin vector $\mathbf{S}$ and vector $\mathbf{r}_x$ according to the geometric approach [4]

$$\mathbf{S} \equiv \mathbf{r}_x. \tag{2}$$

Then (1a), (1b) take the form

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