

Referee report on the paper
”Bethe vectors and recurrence relations
for twisted Yangian based models”
by Vidas Regelskis

This paper is devoted to the investigation of twisted Yangian based models in the framework of the algebraic nested Bethe ansatz. It is a continuation of the previous work [A. Gerrard, N. MacKay, V. Regelskis, Nested algebraic Bethe ansatz for open spin chains with even twisted Yangian symmetry, Ann. Henri Poincare 20, 339–392 (2019)] to the odd case when underlying Lie algebra is \mathfrak{gl}_{2n+1} . Among results obtained in the present paper there are the recurrence relations for the Bethe vectors. As it was mentioned by the author in the conclusion, these relations provide elegant expressions when the rank is small. For the higher rank the recurrence relations become rather complex, but nevertheless they open a door to investigation of the norms and scalar products of the Bethe vectors for the open spin chain models.

The paper is rather technical and it will require a lot of work from the reader to understand author’s notations and calculations. Nevertheless it presents new results on the twisted Yangian based quantum integrable models and met Journal’s acceptance criteria. I would like to recommend the paper ”Bethe vectors and recurrence relations for twisted Yangian based models” by Vidas Regelskis for publication in SciPost Physics Journal after several corrections listed below.

- **Line 106.** In the definition of transposed matrix $\widehat{S}^{(2\hat{n})}$ should be $\widehat{\omega}(S^{(2\hat{n})})$, not $\widehat{\omega}(R^{(2\hat{n})})$.
- **Formula (20).** What is a definition of $\sigma(i)$ and $\sigma(j)$? Below, in the line 227, there is a definition of σ_i . Are $\sigma(i)$ and σ_i the same? If yes, then this definition should be replaced from the page 10 to some place earlier around equality (20). If no, then a definition of $\sigma(i)$ should be provided.
- **Formula (43).** For the reader convenience, I think it is reasonable to recall definition of $\tilde{\nu}$ in this formula writing, for example,

$$p(\nu) := 1 \pm \frac{1}{\nu - \tilde{\nu}} = 1 \pm \frac{1}{2\nu + \rho}.$$

- **Line 257.** Correct typo ’repating’ \rightarrow ’repeating’.

- **Line 375.** Correct typo 'onsider' → 'consider'.