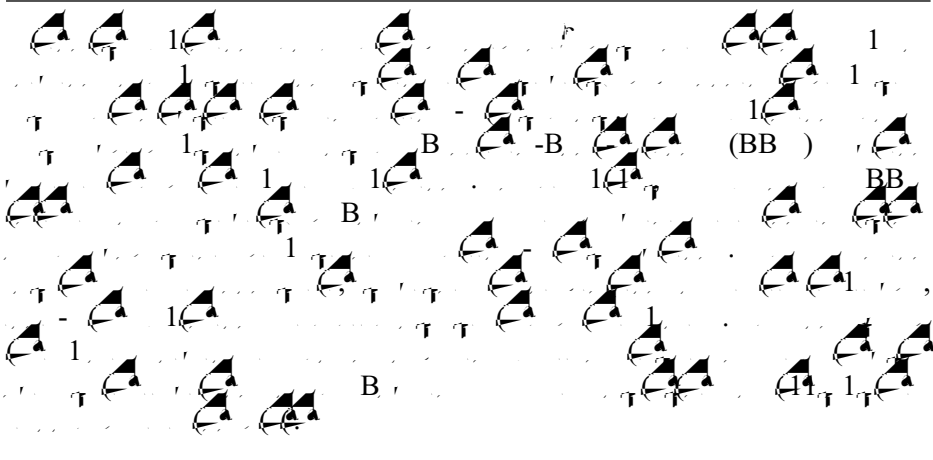
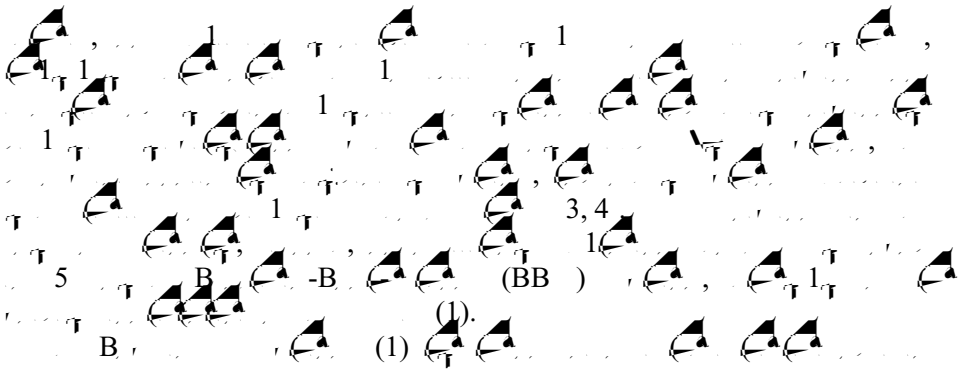


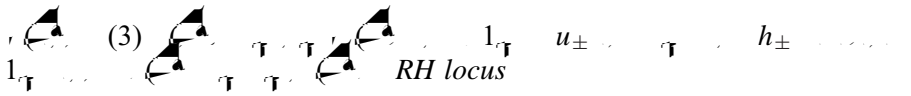
Spin Exchange for a Regulated Bosonic System

By Gennady A. El, Mark A. Hoefer , and Michael Shearer



1. Introduction



(3)  u_{\pm} h_{\pm} RH locus

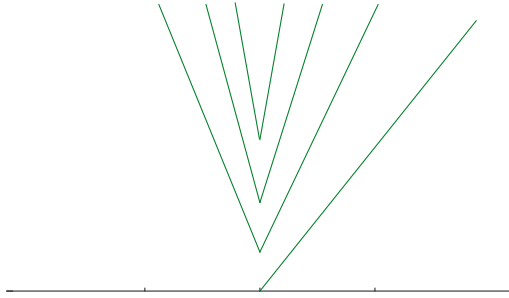
$$u_{\pm} = h_{\mp} \left(\frac{2}{h} \right)^{k-2} \quad (4)$$

(2) (3)  u_{\pm} h_{\pm} RH locus (1),

2. Expansion shock Riemann data



$$h_t \quad ($$



$$r^{(0)}, r^{(1)}, r^{(2)}, s^{(0)}, s^{(1)}, s^{(2)} \rightarrow 0, \delta \rightarrow 0, \rightarrow 0. \quad (15)$$

$$\dots \quad (21) \quad \dots \quad (20), \quad \dots$$

$$(\epsilon r^{(1)} \dots)$$

$$\frac{1}{4\delta} (3r^{(0)} \quad s^{(0)} \quad 3\epsilon r^{(1)} \quad \epsilon^2(3r^{(2)} \quad s^{(2)} \quad \dots)) (\epsilon r^{(1)} \quad \epsilon^2 r^{(2)} \quad \dots)$$

$$\frac{1}{6\delta^2} (\epsilon r^{(1)} \quad \epsilon^2 (r^{(2)} \quad s^{(2)} \quad \dots)) \quad (22)$$

$$(\epsilon^2 s^{(2)} \quad \dots) \quad \frac{1}{4\delta} (r^{(0)} \quad 3s^{(0)} \quad \dots) (\epsilon^2 s^{(2)} \quad \dots) \quad (23)$$

$$\frac{1}{6\delta^2} (\epsilon r^{(1)} \quad \dots)$$

B $\ll k < \delta, \dots \quad (22)$

$$\left(\frac{\epsilon}{\delta}\right) : \frac{1}{\delta}$$

$$K / 0 \quad \frac{2a}{9a^2} \quad \frac{ff'}{f''} \quad K. \quad (30)$$

$$a(\cdot) = \frac{A}{\frac{9}{2}AK - 1} \cdot f(\cdot) \quad B \left(\frac{B}{2K} \right). \quad (31)$$

$$B - 1 \cdot K = \frac{1}{2}. \quad (32)$$

$$a(\cdot) = \frac{A}{\frac{9}{4}A - 1} \cdot f(\cdot). \quad (33)$$

$$r^{(0)}(\cdot) = \frac{s^{(0)}}{3} \pm \frac{\sqrt{A}}{\frac{9}{4}A - 1} \quad (\leftarrow^2). \quad (34)$$

$$s^{(0)}(\cdot) = s^{(0)} \quad (\leftarrow^2). \quad (35)$$

$$r_{\pm} = \frac{s^{(0)}}{3} \pm \sqrt{A} \quad (\leftarrow^2). \quad (36)$$

s_{\pm}



$$r^{(c)}(\xi) \sim 1 - \epsilon \left(\frac{1}{4} - \frac{\xi(\xi)}{1 - \frac{9}{4}} \right) - \frac{\epsilon^2}{3} \left(C - \frac{2 - 17\xi^2(\xi) - D\xi(\xi) - E\xi^3(\xi)}{16(1 - \frac{9}{4})^2} \right).$$

$$s^{(c)}(\xi) \sim 3 - \frac{3}{4} \epsilon \left(C - \frac{3 - \xi^2(\xi)}{16(1 - \frac{9}{4})} \right)$$

... (58). ... (50), ...

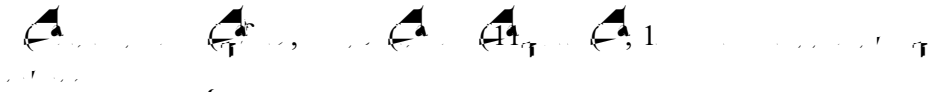
$$r_2(X) \underset{X \rightarrow 0^\pm}{\sim} F_2^\pm \frac{1}{\left(1 - \frac{9}{4}\right)^2} \rightsquigarrow_{\pm} r^{(2)}(X) = \frac{1}{24\left(1 - \frac{9}{4}\right)^2}. \quad (60)$$

... F_2 F_2 $k < 24$, ...

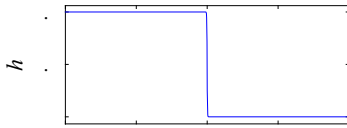
$$r_2(X) = \frac{1 - 3X}{24\left(1 - \frac{9}{4}\right)^2} \quad (61)$$

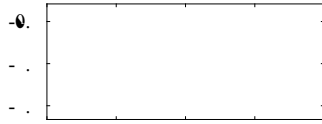
... (11) ...

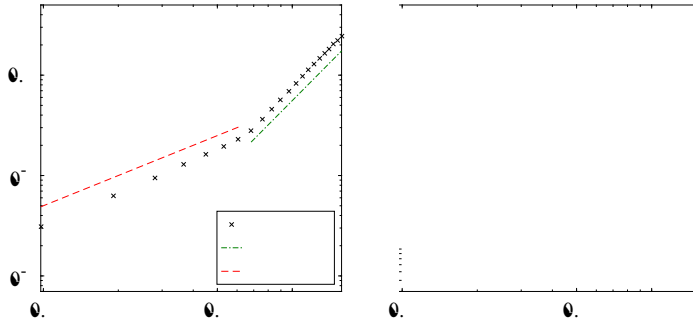
$$r^{(1)}(X) = 1 - \left(\frac{1}{4} - \frac{X - 3X}{1 - \frac{9}{4}} \right) \\ \rightsquigarrow^2 \left(\frac{1}{4} - 1 - 3 \right)$$



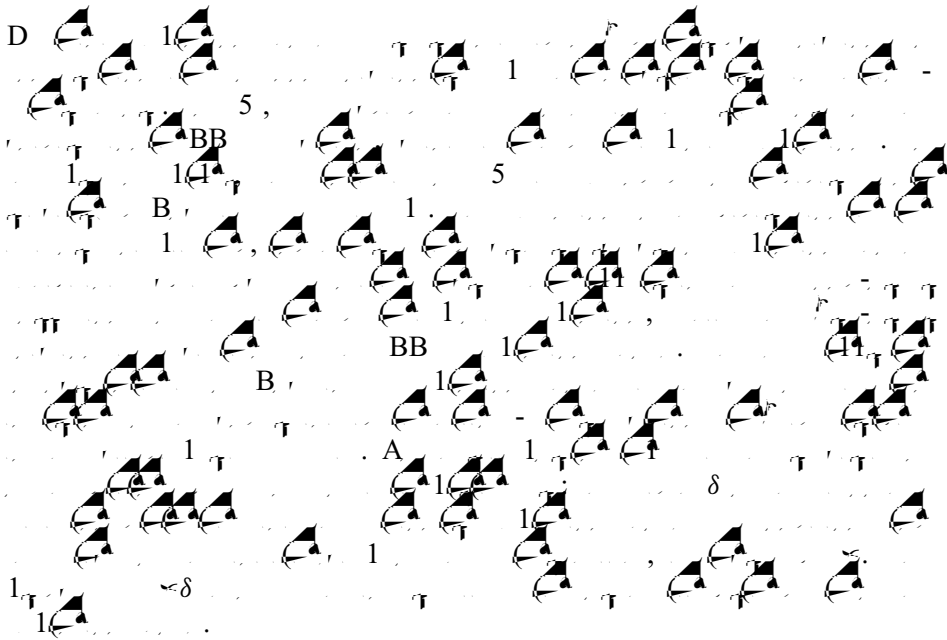
$$r^{(0)}(X, \cdot) = 1 \quad \left\{ \begin{array}{l} \\ \\ \\ \\ \end{array} \right.$$







6. Discussion



Acknowledgments

The authors would like to thank the referees for their valuable comments and suggestions. This work was supported by the National Natural Science Foundation of China (Grant No. 11171291) and the National Natural Science Foundation of China (Grant No. 1255422).

Appendix

A.1. Let $u(x, t)$ and $h(x, t)$ be the solutions of the initial-boundary value problem (1) and (2) respectively. Then, we have the following lemma.

$$g_t - (ug)_x - (h^2)_x = 0, \quad (A1)$$

$$g_t - (u^2)_x - g_x = \frac{1}{3} u_{xxt} = 0$$

B. Let $h(\pm L, t) = h_{\pm}$ and $u(\pm L, t) = u_{\pm}$ be the boundary values of h and u respectively. Then, we have the following lemma.

$$f(u)_x - n = ik_n f(u)_n, \quad n = N-2, \dots, N-2-1. \quad (A2)$$

Let $h(x_n, t) = h$ and $g(t)_n = \frac{1}{2L}(h - h^2)(x_n - L)$.

$$h(x_n, t) = h \quad f^{-1} g(t)_n = \frac{1}{2L}(h - h^2)(x_n - L). \quad (A3)$$

$$g_n(t) = \begin{cases} \frac{2L}{N} \sum_{m=N-2}^{N-2-1} x_m g(x_m, t) & n = 0 \\ \frac{g_n(t)}{ik_n} & n = 0 \end{cases} \quad (A4)$$

Let $g(x, t) = \int_{-L}^L x g(x, t) dx$ and $h(x, t) = \int_{-L}^L h(x, t) dx$.

The diagram consists of several interconnected elements:

- At the top, there are two horizontal sequences of symbols, each starting with a '1' and followed by several 'T' symbols.
- Below these, there are various mathematical and symbolic expressions: 0.002 , $xx < 3$, $45.$, and $L 120$.
- On the left side, there is a vertical sequence of numbers: 1 , 2 , and $N 2^{14}$.
- Arrows and other symbols (like 'T' with a dot) connect these elements, suggesting a flow or relationship between them.
- The label $(A1)$ is placed in the center of the diagram.