Piston Dispersive Shock Wave Problem

E
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two

$$i\varepsilon \quad_t = -\frac{\varepsilon^2}{2} \quad + V_0(\ ,t) \quad + |\ |^2 \ , \qquad 0 < \varepsilon \ll 1. \qquad ( )$$

ε E

$\varepsilon = 0.015$ E

$V_0(\ ,t) = V_{max} H(\ _p t -$) $H(\ )$

V_{max} p

$(\ ,0) \to \sqrt{\rho_R}$ $\to \infty$ $(\ ,0) \to 0$ $\to -\infty$

$V_{max} \gg \rho_R$

$V_{max} H(-\ )$

$t \leq 0$ $\rho_R = 0.133$

, , E ( )

$= \sqrt{\rho}\exp[\frac{i}{\varepsilon}\int_0 (', t)d ']$

, ,

$$\rho_t + (\rho\ ) = 0,$$

$$(\rho\ )_t + \left(\rho\ ^2 + \frac{1}{2}\rho^2\right) = \frac{\varepsilon^2}{4}[\rho(\log\rho)\ ] - \rho V_0\ , \quad ( )$$

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, r_3 ,
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$$ {}_s^- = \frac{1}{2}\,{}_p + \sqrt{\rho_R}, \qquad {}_s^+ = \frac{2\,{}_p^2 + 4\,{}_p\sqrt{\rho_R} + \rho_R}{{}_p + \sqrt{\rho_R}}. $$
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$$ \rho_{\min} = \left(\sqrt{\rho_R} - \frac{1}{2}\,{}_p\right)^2, \qquad {}_{\min} = -\,{}_p\left(\frac{\sqrt{\rho_R} + \frac{1}{2}\,{}_p}{\sqrt{\rho_R} - \frac{1}{2}\,{}_p}\right). $$
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, , ,
$\rho_{\max} = \rho_L = ({}_p/2 + \sqrt{\rho_R})^2 \quad {}_{\max} = {}_L = {}_p$

E ( ) $= V = {}_p$ (, ,

,)

$l = 2\varepsilon K(4\rho_R/{}_p^2)/{}_p$

(

, , σ) ${}_s^- =$
${}_p + ({}_p + 3\sqrt{\rho_R})[\frac{{}_pE(4\rho_R/{}_p^2)}{({}_p - 2\sqrt{\rho_R})K(4\rho_R/{}_p^2)} - 1]^{-1}$

${}_s^+$ E ( )

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$N_{\mathrm{vac}}(t) \approx \lceil\frac{{}_s^- - {}_p}{l}t\rceil = \lceil\frac{({}_s^- - {}_p){}_p}{2\varepsilon K(4\rho_R/{}_p^2)}t\rceil$

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${}_s^-$ E ( ) , ,

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$({}_p = \sqrt{\rho_R})$ $({}_p = 2.5\sqrt{\rho_R})$

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, , , E ( )

$= {}_p$