Amorphous molecular beam epitaxy: global solutions and absorbing sets

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The parabolic equation

$$u_t + u_{xxxx} + u_{xx} = -(|u_x|^\alpha)_{xx}, \qquad \alpha > 1,$$

is studied under the boundary conditions $u_x|_{\partial\Omega} = u_{xxx}|_{\partial\Omega} = 0$ in a bounded real interval Ω. Solutions from two different regularity classes are considered: It is shown that unique *mild* solutions exist locally in time for any $\alpha > 1$ and initial data $u_0 \in W^{1,q}(\Omega)$ $(q > \alpha)$, and that they are global if $\alpha \leq \frac{5}{3}$. Furthermore, from a semidiscrete approximation scheme global *weak* solutions are constructed for $\alpha < \frac{10}{3}$, and for suitably transforms of such solutions the existence of a bounded absorbing set in $L^1(\Omega)$ is proved for $\alpha \in [2, \frac{10}{3})$. The article closes with some illustrative numerical examples.

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