Solitary Wave and Wave Front as Viewed From Curvature

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Abstract: The solitary wave and wave front are two important behaviors of nonlinear evolution equations. Geometrically, solitary wave and wave front are all plane curve. In this paper, they can be represented in terms of curvature $c(s)$, which varies with arc length s. For solitary wave when $s \to \pm\infty$, then its curvature $c(s)$ approaches zero, and when $s=0$, the curvature $c(s)$ reaches its maximum. For wave front, when $s \to \pm\infty$, then its curvature $c(s)$ approaches zero, and when $s=0$, the curvature $c(s)$ is still zero, but $c'(s) \neq 0$. That is, $s=0$ is a turning point. When $c(s)$ is given, the variance at some point (x,y) in stream line with arc length s satisfies a 2-order linear variable-coefficient ordinary differential equation. From this equation, it can be determined qualitatively whether the given curvature is a solitary wave or wave front.

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