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QUENCHING OF SOLUTIONS OF SEMILINEAR EULER-POISSON-DARBOUX EQUATIONS

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Abstract. Let D be a bounded n-dimensional domain with a piecewise smooth boundary ∂D, k be any real number, and Δ be the n-dimensional Laplace operator. This article studies the following first initial-boundary value problem:

$$u_{tt} + \frac{k}{t}u_t - \Delta u = f(u),\ (x,t) \in D \times (0,T),$$

$$u(x,0) = u_0(x), u_t(x,0) = 0,\ x \in D,$$

$$u(x,t) = 0,\ (x,t) \in \partial D \times [0,T),$$

where for some positive constant c, $\lim_{u \to c^-} f(u) = \infty$. Criteria for a weak solution u of the problem to reach the value c somewhere and the blow-up of u_t are given.
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1. Introduction

The concept of quenching was introduced in 1975 by Kawarada [15] through a first initial-boundary value problem for a semilinear heat equation. Chang and Levine [12] extended the concept to a first initial-boundary value problem for a semilinear wave equation in 1981. Quenching phenomena for parabolic equations have been studied extensively (cf. Chan [1], Chan and Ke [2], Chan and Kong [3, 4, 5], Chan and Liu [6, 7], Chan and Nip [10], Chan and Yuen [11], Guo and Hu [16], Yuen [19], and the references there). Not as many results have been obtained for hyperbolic equations. For the one-dimensional semilinear Euler-Poisson-Darboux equations, Chan and Nip [8, 9] studied, respectively, the critical length, and the blow-up of the second derivative of the solution with respect to time at quenching. The impulsive effects on quenching for semilinear wave equations was studied by Nip [17]. Here, we would like to study quenching and blow-up of the derivatives of the solutions for first initial-boundary value problems involving the n-dimensional semilinear Euler-Poisson-Darboux equations.