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SINGULAR SURFACES IN DIPOLAR MATERIALS AND POSSIBLE CONSEQUENCES FOR CONTINUUM MECHANICS

B. STRAUGHAN

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Department of Mathematics, University of Glasgow
University Gardens, Glasgow G12 8QW
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B. Straughan, University of Glasgow.

1. Introduction

In this paper we study the evolutionary behaviour of a propagating singular surface in two types of nonlinear dipolar materials; a compressible inviscid dipolar fluid and an elastic dipolar solid.

The basic theory we use was introduced by Green and Rivlin [1] and from the constitutive theory viewpoint essentially extends classical continuum mechanics by including gradients of the independent variables present in non-polar theories. Gradient type theories were suggested earlier by, for example, Maxwell and by Korteweg, see Truesdell and Noll [2], §125; in particular, Korteweg developed an interesting theory of surface tension by allowing for the possibility of rapidly changing density gradients in an interface. Since in a singular surface quantities such as density and its gradients of various orders may change very rapidly a study of wave motion in multipolar materials may prove of value.

For an elastic dipolar material the theory we employ was derived by Green and Rivlin [1], whereas the constitutive development for dipolar fluid theory is due to Bleustein and Green [3].