

# *The Impulsive Reissner-Sagoci Problem*

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**1. Introduction.** In recent years considerable attention has been devoted to the calculation of transient and periodic disturbances in an elastic half-space. For example Eason [1] has treated the motion of a half-space resulting from the sudden application of an axisymmetric distribution of normal stress to a circular area of its plane face, and Ghosh [2] has applied Cagniard's method to the torsional motion of a half-space whose surface is subjected to an impulsive distribution of shear stress. The classical periodic problem is that of Reissner and Sagoci [3] in which torsional oscillations are excited in a half-space by means of a rigid harmonically oscillating disc, securely attached to the plane face. In [3] this problem is solved in terms of spheroidal wave functions whereas more recent treatments have been based on integral equation formulations of the mixed boundary value problem (*e.g.* Collins [4]). In the high frequency range solutions have been presented by Stallybrass [5] and Thomas [6]; unfortunately the asymptotic formulae given by these authors for the radiator driving couple do not agree.

The purpose of this paper is to treat a transient mixed boundary value problem of the Reissner-Sagoci type. At time  $t = 0$  the disc is impulsively twisted through an angle  $\alpha$  and held in the displaced position; thus a shear wave is generated in the material and as  $t \rightarrow \infty$  the strain field tends to that of the static Reissner-Sagoci situation [7].

After Laplace transforming with respect to time the mixed boundary value for  $\bar{v}$ , the transform of the transverse particle displacement  $v$ , is formally identical with that of [5] if the wave number  $k$  is replaced by  $ip/\beta$  ( $p$  is the transform variable and  $\beta$  the shear wave speed). It is tempting to use this replacement to calculate an asymptotic form of  $\bar{v}$  for large  $p$ , thereby obtaining on inversion the form of  $v$  for small  $t$ . However, in view of the disagreement noted above between [5] and [6], a treatment of the boundary value problem for  $\bar{v}$  is given in some detail, based on the work of Noble [8] and Stallybrass [5]. An explicit form is then found for the surface displacement of the half-space for small times. We also compute for small times the couple necessary to hold the disc in its displaced position. In principle it is possible to use Kirchhoff's formula to derive the dis-