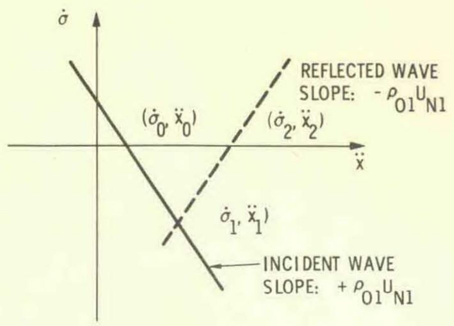

FIG. 7. Stress rate—acceleration diagram of acceleration wave reflection from a stress-free boundary.

Collision of two acceleration waves

Let us consider the interaction of a right-running wave connecting the state $(\dot{\sigma}_2, \ddot{x}_2)$ with the state $(\dot{\sigma}_2, \ddot{x}_2)$ and a left-running wave connecting the state $(\dot{\sigma}_2, \ddot{x}_2)$ with the state $(\dot{\sigma}_3, \ddot{x}_3)$. The characteristic lines for each of these waves are as shown in Fig. 6. State 2 must lie at the intersection of the left- and right-running wave characteristics, because this is the only point on both lines. This state satisfies (A1). After the wave interaction the waves adjacent to states 1 and 3 are propagating in the opposite direction to what they were previously, so the state 4 between them must lie on each of the dotted cross curves, as shown in the Fig. 6.

Collision of an acceleration wave with a contact surface

As with any acceleration wave, the incident wave can be represented by a straight line connecting states in the $(\dot{\sigma}, \ddot{x})$ plane. The reflected wave lies on a line through $(\dot{\sigma}, \ddot{x}_1)$ with slope $\rho_{01}U_{N1}$ and the transmitted wave lies on a line through $(\dot{\sigma}_0, \ddot{x}_0)$ with slope $-\rho_{02}U_{N2}$. Since both $\dot{\sigma}$ and $\ddot{x}$ are continuous across the contact surface, the state between the two waves corresponds to the point $(\dot{\sigma}_2, \ddot{x}_2)$ where the transmitted- and reflected-wave curves intersect. This solution satisfies (A7) as, of course, it must.

Reflection of an acceleration wave from a free surface

As mentioned previously, the free-surface reflection problem is a special case of the contact surface interaction problem in which the second material is replaced by a void. In this case $\dot{\sigma}=0$ and $\rho_{02}U_{N2}=0$, and we have the situation illustrated in Fig. 7. From the drawing we obtain the results (5.10) given previously.

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