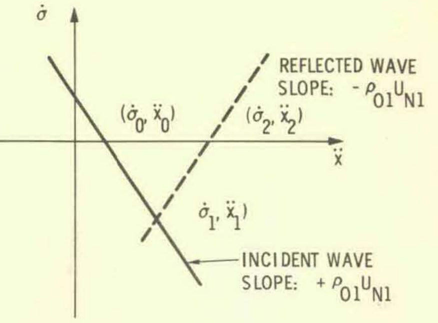

FIG. 7. Stress rate—acceleration diagram of acceleration wave reflection from a stress-free boundary.

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.

*This work was supported by the U. S. Atomic Energy Commission.
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