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COMMENTS ON THE PAPER "MOTION INDUCED BY AXISYMMETRIC BODIES VIBRATING ALONG THE AXIS OF ROTATION OF AN INFINITE ROTATING LIQUID" BY R. K. GUPTA

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Gupta (1982) solves the problems of obtaining the velocity distributions for the motions induced by the vibration of (i) a spheroid and (ii) a paraboloid of revolution along the axis of rotation of an infinite mass of rotating inviscid liquid, on the basis of the linearised equations of motion, using Laplace transforms. Problem (i) has been solved by Sarma (1958) (but not as an initial value problem) and as $t \to \infty$, the ultimate velocity distribution (which is the main interest in such problems) of Gupta (1982) is similar to that of Sarma (1958). Both obtain the same characteristic cones on which the velocity is infinite.

Problem (ii) has also been solved by Kasture (1964). Corrections to Gupta's paper, based on the comparison of the corresponding results in Gupta (1982) and Kasture (1964) are given below.

(1) It is well known, Goldstein (1960), that the initial motion just when the paraboloid starts, should be irrotational. Hence the third condition in eqn. (2.6) in Gupta (1982) is incorrect. It should be replaced by eqn. (3) in Kasture (1964). This type of incorrect initial condition was also taken by Stewartson (1952), which was later corrected by Morgan (1953).

(2) There are some printing mistakes in eqn. (5.5) and (6.3) in Gupta's paper (1982) which can be corrected by noting the corresponding equations (14) and (16) in Kasture (1964).

(3) Gupta's (1982) eqns. (6.8) onwards imply that ultimately (when $t \to \infty$) the infinite mass of inviscid liquid vibrates with the paraboloid. This incorrect unrealistic conclusion is a consequence of not taking into account the contributions from the poles at $s = \pm i\beta$ while evaluating the integrals in (5.5). If these contributions are taken into account, it is found that u, v, w have a harmonic part which does not vanish as $t \to \infty$, Kasture (1964) [eqns. (18)].

(4) Gupta's (1982) equation (6.8) onwards imply that the velocity is infinite on the surface

$$(4\,\Omega^2\,\xi_1^2 - \beta^2)\,(4\,\Omega^2\,\xi_2^2 - \beta^2) = 0$$

which gives a cone generated by the lines

$$4\,ar = \pm\,(4\,az - \lambda^2 + 1)/(\lambda^2 - 1)^{1/2}$$

which touches the paraboloid. Therefore his conclusion that no such cones exist is invalid. Kasture (1964) obtains the cone and shows that the flow across this cone is negligible for large λ.

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