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COMMENTS ON "STEADY PLANE MHD FLOWS WITH CONSTANT SPEED ALONG EACH STREAMLINE"

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A paper entitled "Steady Plane MHD Flows with Constant Speed Along Each Streamline" authored by M. A. Sattar was published in *Indian J. pure appl. Math.* 18 (1987), 548-56. Exactly the same work authored by M. A. Sattar and O. P. Chandna appeared in *J. Math. Phy. Sci.* 22 (1988), 321-33. Although Dr Sattar did this work jointly with me, I was totally unaware of its submission to these journals by him. The mathematical analysis of this work has two cases when

$$J = \begin{vmatrix} \frac{\partial u}{\partial x} & \frac{\partial u}{\partial y} \\ \frac{\partial v}{\partial x} & \frac{\partial v}{\partial y} \end{vmatrix} = \frac{\partial u}{\partial x}\frac{\partial v}{\partial y} - \frac{\partial u}{\partial y}\frac{\partial v}{\partial x}$$

is nowhere zero in the region of flow and when J is everywhere zero in the region of flow. The summing up of the case when $J = 0$ everywhere needs correcting. This summing up should read : The steady plane flow of a viscous incompressible fluid of infinite electrical conductivity having constant velocity magnitude along each streamline has only constant solutions given by (3.31) when $J = 0$ and the streamlines for such a flow are parallel straight lines.

The above correction implies that the non-constant solutions given in (3.35) are not possible for the subcase taken. This subcase has

$$u^2 + \phi^2(u) = u^2 + v^2 = \text{constant} = c\text{-say}$$

$$u_x + \phi'(u)\, u_y = 0 \qquad \ldots(3.27)$$

$$\{u^2 + u\,\phi(u)\,\phi'(u)\}\, u_x + \{u\phi(u) + \phi^2(u)\,\phi'(u)\}\, u_y = 0 \qquad \ldots(3.28)$$

$$\{2u\,\phi(u) + \phi^2(u)\,\phi'(u) - u^2\,\phi'(u)\}\, u_x + \{\phi^2(u) - u^2 - 2u\phi(u)\,\phi'(u)\}\, u_y = 0 \qquad \ldots(3.29)$$

where c is an arbitrary constant and $\frac{\partial u}{\partial y} \neq 0$.

Since $2u+2\phi(u)\,\phi'(u)=0$ is a consequence of the assumption $u^2+\phi^2(u)=$ constant taken as Case III in paper, it follows that equation (3.28) is identically satisfied. Eliminating $\frac{\partial u}{\partial x}$ from equations (3.27) and (3.29) and requiring $\frac{\partial u}{\partial y}\neq 0$, we find that $\phi(u)$ must satisfy

$$\phi^2(u)\,\phi'^2(u)-u^2\,\phi'^2(u)-\phi^2(u)+u^2+4u\phi(u)\,\phi'(u)=0.$$

Employing $\phi(u)=\pm\sqrt{c-u^2}$ in this equation to be satisfied by $\phi(u)$, we conclude that

$$c=0$$

and, therefore,

$$u^2+\phi^2(u)=u^2+v^2=0.$$

This equation implies that subcase III, for the case $J=0$, given in the paper is not physically possible.