Three-dimensional Hiemenz Stagnation-Point Flows PATRICK
WEIDMAN, Department of Mechanical Engineering — A modification of Hiemenz's
two-dimensional outer potential stagnation-point flow of strain rate a is obtained by
adding periodic radial and azimuthal velocities of the form $br\sin 2\theta$ and $br\cos 2\theta$,
respectively, where b is a shear rate. This leads to the discovery of a new family of
three-dimensional viscous stagnation-point flows depending on the shear-to-strain
rate ratio $\gamma = b/a$ that exist over the range $-\infty < \gamma < \infty$ with reflectional sym-
metry about $\gamma = 0$. Numerical solutions for the wall shear stress parameters and
the displacement thicknesses are given and compared with their large-γ asymptotic
behaviors. Sample similarity profiles are also presented.

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