Regenerative transient growth on a vortex column\textsuperscript{1} ERIC STOUT, FAZLE HUSSAIN, U. Houston — Perturbations on a Lamb-Oseen vortex column with a circulation overshoot (due to a sheath of negative axial vorticity, $-\Omega_z$, surrounding the core) are studied by DNS of the incompressible Navier-Stokes equations, for a range (500-12500) of the vortex Reynolds number ($Re=\text{circulation/viscosity}$). Initial perturbation radial (rad.) vorticity is tilted by the mean strain into perturbation azimuthal (az.) vorticity, which generates positive Reynolds stress necessary for energy growth. The meridional flow of az. vorticity tilts $-\Omega_z$ into intensifying rad. vorticity, increasing the +Reynolds stress, which results in exponential energy growth. +Reynolds stress also transports azimuthal momentum radially outward, reducing the overshoot magnitude, which determines $-\Omega_z$. The resulting decreased rad. vorticity reduces the +Reynolds stress, arresting instability growth (with concomitant increase in viscous dissipation). Outward transport of azimuthal momentum also produces -Reynolds stress, which then transports azimuthal momentum inward. A new circulation peak appears nearer to the column axis, initiating a period of new, regenerative transient growth — a promising scenario for turbulence generation near the vortex column.

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