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Simulations of vertical disruptions with VDE code: Hiro and Evans currents[1] XUJING LI, Academy of Mathematics, CAS, DI HU TEAM, LEONID ZAKHAROV TEAM, GALKIN TEAM — The recently created numerical code VDE for simulations of vertical instability in tokamaks is presented. The numerical scheme uses the Tokamak MHD model, where the plasma inertia is replaced by the friction force, and an adaptive grid numerical scheme. The code reproduces well the surface currents generated at the plasma boundary by the instability. Five regimes of the vertical instability are presented:

1. Vertical instability in a given plasma shaping field without a wall;
2. The same with a wall and magnetic flux $\Delta\Psi|_{pl}^{X} < \Delta\Psi|_{X}^{wall}$ (where X corresponds to the X-point of a separatrix);
3. The same with a wall and magnetic flux $\Delta\Psi|_{pl}^{X} > \Delta\Psi|_{X}^{wall}$;
4. Vertical instability without a wall with a tile surface at the plasma path;
5. The same in the presence of a wall and a tile surface.

The generation of negative Hiro currents along the tile surface, predicted earlier by the theory and measured on EAST in 2012, is well-reproduced by simulations. In addition, the instability generates the force-free Evans currents at the free plasma surface. **The new pattern of reconnection of the plasma with the vacuum magnetic field is discovered.**

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