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Erratum: “Nonlinear modeling of forced magnetic reconnection in slab geometry with NIMROD” [Phys. Plasmas 24, 052508 (2017)]

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The linear layer response time is evaluated inappropriately in Ref. 1. This affects analytic predictions for linear and quasilinear magnetic field penetration due to a resonant, externally applied field according to Eqs. (14) and (19) of Ref. 1, respectively. The linear layer response time for the visco-resistive regime is given according to Ref. 2 as $\tau_{VR} = 2.104\tau_{shA}S_{sh}^{2/3}P_m^{1/6}$, where $\tau_{shA} \equiv \tau_A/k_y a$ is the local shear Alfvén time at the rational surface (called the local hydro-magnetic time τ_H in Ref. 2) and $S_{sh} = Sk_y a$ is the local Lundquist number. However, Ref. 1 inadvertently omits the

factor of $k_y a$ in τ_{shA} , evaluating τ_{VR} using the Alfvén time τ_A based on the sheared magnetic field strength at the computation boundary. The proper evaluation of τ_{VR} results in a linear layer response time that is $(k_y a)^{1/3} = \pi^{-1/3} \simeq 0.68$ shorter than that in Ref. 1. The value of the time τ'_{VR} used to predict quasilinear equilibria according to Eq. (19) is shorter by the same factor.

Using the correct value of τ_{VR} has a direct effect on analytic predictions for the magnitude and phase of the linear penetrated field, consistent with Eq. (14) in Ref. 1. Figure 1

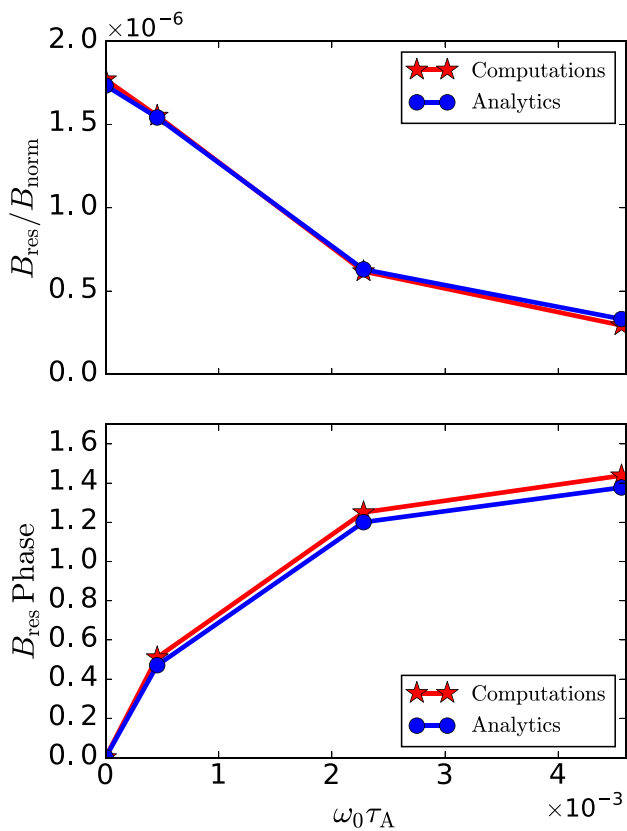


FIG. 1. Parametric scaling of (a) reconnected field amplitude and (b) phase at the resonant surface as the equilibrium flow along the resonant surface $V_{y,0}$ is varied for a constant applied field of $B_{ext} = 2 \times 10^{-5} B_{norm}$. The amplitude characterizes how the reconnected field decreases as the flow is increased. The phase shows the transition from being in phase at $\omega_0 = 0$ toward being completely out of phase as ω_0 is increased. Red data (*) shows computation results and blue data (●) shows analytic results, which are quite consistent.

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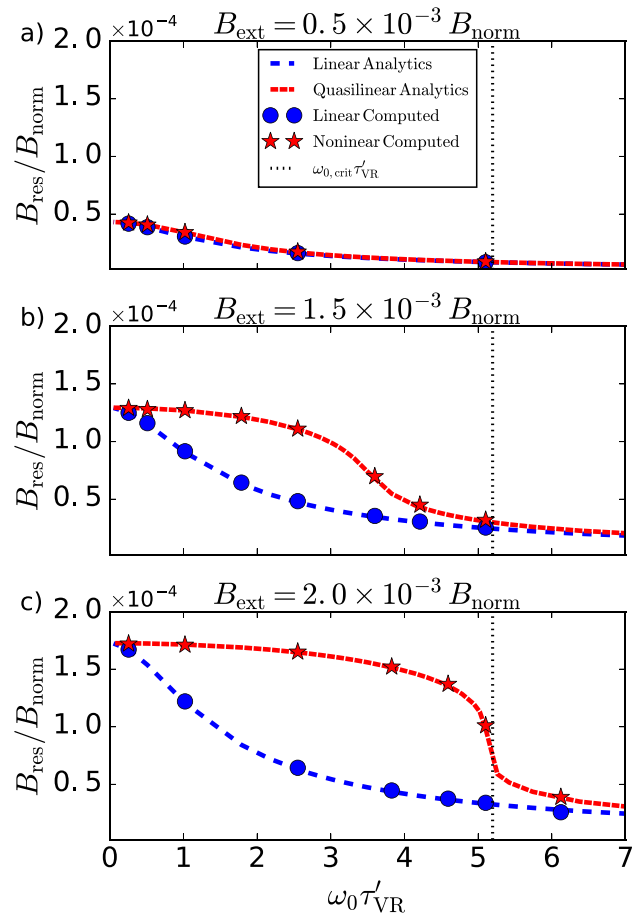


FIG. 2. Comparison between linear (blue data) and nonlinear (red data) analytic theory (dashed lines) and computation results (circles and stars) for a parametric scan of initial flow frequency. The applied magnetic field varies between the plots, and nonlinear results exhibit increased reconnection compared to the linear results as the applied field is increased. Note that there is no discontinuous transition from a low-slip to a high-slip state, because $B_{ext} < B_{ext,pen}(\omega_{0,crit}) = 2.02 \times 10^{-3} B_{norm}$.

replaces Fig. 5 of Ref. 1, exhibiting even better agreement between NIMROD computations and analytic predictions. The highest percent difference in penetrated field magnitude is 11% and in phase is 8%.

There is also a concomitant effect on the predicted quasilinear field penetration, consistent with Eq. (19) of Ref. 1. Figure 2 replaces Fig. 12 of Ref. 1, now exhibiting agreement between NIMROD computations and analytic predictions. The highest percent difference in penetrated field magnitude is less than 2% for nonlinear computations and less than 3% for linear computations. Note that there is no discontinuous transition from a low-slip to a high-slip state because $B_{\text{ext}} < B_{\text{ext,pen}}(\omega_{0,\text{crit}}) = 2.02 \times 10^{-3} B_{\text{norm}}$, consistent with Eq. (25) in Ref. 1. As τ'_{VR} decreases, $\omega_{0,\text{crit}}$ increases according to Eq. (20) in Ref. 1, which increases $B_{\text{ext,pen}}(\omega_{0,\text{crit}})$ according to Eq. (22) in Ref. 1. Also note that additional linear and nonlinear computations were run to exhibit the transition from a mode penetrated to a flow-screened time-asymptotic state as ω_0 is increased in Fig. 2(c).

Data used to generate figures can be obtained in digital format by following the link in Ref. 3.

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³See <https://cptc.wisc.edu/report/> for data used to generate figures.