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Effect of collisions on the two-stream instability in a finite length plasma PETER L.G. VENTZEK, Tokyo Electron America, Austin, Texas 78741, USA, DMYTRO SYDORENKO, University of Alberta, Edmonton, Alberta T6G 2E1, Canada, IGOR D. KAGANOVICH, Princeton Plasma Physics Laboratory —
The instability of a monoenergetic electron beam in a collisional one-dimensional plasma bounded between grounded walls is considered both analytically and numerically. Collisions between electrons and neutrals are accounted for the plasma electrons only. Solution of a dispersion equation shows that the temporal growth rate of the instability is a decreasing linear function of the collision frequency which becomes zero when the collision frequency is two times the collisionless growth rate. This result is confirmed by fluid simulations. Practical formulas are given for the estimate of the threshold beam current which is required for the two-stream instability to develop for a given system length, neutral gas pressure, plasma density, and beam energy. Particle-in-cell simulations carried out with different neutral densities and beam currents demonstrate good agreement with the fluid theory predictions for both the growth rate and the threshold beam current.

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