Avalanche Runaway Growth Rate from a Momentum-Space Orbit Analysis

P.B. Parks, M.N. Rosenbluth,[a] and S.V. Putvinski[a]

General Atomics, P.O. Box 85608,
San Diego, California 92186-5608, U.S.A.

Abstract

The growth of avalanche runaway electrons, a potentially serious issue for disruptions in high-current tokamaks, was recently studied by Monte-Carlo and numerical solutions of the relativistic Fokker-Planck equation. Here a new analytical formulation based on the analysis of the particle trajectories of the knocked out secondary electrons offers insight and yields an analytical expression for the growth rate over the entire parameter range of interest. The growth rates are compared with the numerical simulations and analytical solutions of the Fokker-Planck equation in various limits [M.N. Rosenbluth and S.V. Putvinski, Nucl. Fusion 37, 1355 (1997)], and are found to be in good agreement.

[a]ITER Joint Work Site, 11025 North Torrey Pines Road, La Jolla, California 92037, U.S.A.