We study strain rate controlled plastic deformation of crystalline solids via two-dimensional discrete dislocation dynamics simulations. The resulting stress-strain curves are characterized by dislocation avalanches visible as fluctuations. We characterize the average stress-strain curves as well as the statistical properties of strain bursts and the related stress drops as a function of the imposed strain rate and the stiffness of the specimen-machine system. A non-stationary occurrence of the avalanches is observed, and in the limit of small strain rate and driving spring stiffness, the sizes and durations of the dislocation avalanches are power-law distributed. Furthermore, the avalanches exhibit a temporally asymmetric average shape. We discuss the dependence of the results on the driving parameters, and compare our results to those from previous simulations where quasistatic stress-controlled loading was used [1].

Figure 1: Distributions of the strain increments $P(\Delta \epsilon)$ for an imposed strain rate $\dot{\epsilon}_a = 10^{-5}$ and varying driving spring stiffnesses $k$, with corresponding power law fit parameters shown in the inset. A strain increment distribution of stress-loaded samples is included for reference.