A computationally efficient strength model for textured HCP metals undergoing dynamic loading conditions: Application to Magnesium JEFFREY LLOYD, RICHARD BECKER, US Army Research Laboratory — Predicting the behavior of HCP metals presents challenges beyond those of FCC and BCC metals because several deformation mechanisms, each with their own distinct behavior, compete simultaneously. Understanding and capturing the competition of these mechanisms is essential for modeling the anisotropic and highly orientation-dependent behavior exhibited by most HCP metals, yet doing so in a computationally efficient manner has been elusive. In this work an orientation-dependent strength model is developed that captures the competition between basal slip, extension twinning, and non-basal slip at significantly lower computational cost than conventional crystal plasticity models. The model is applied to various textured Magnesium polycrystals, and where applicable, compared with experimental results. Although the model developed in this work is only applied to Magnesium, both the framework and model are applicable to other non-cubic crystal structures.

Jeffrey Lloyd
US Army Research Laboratory