Accepted Manuscript

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PII: S0749-6419(18)30126-8

DOI: 10.1016/j.ijplas.2018.06.013

Reference: INTPLA 2368

To appear in: *International Journal of Plasticity*

Received Date: 2 March 2018

Revised Date: 9 June 2018

Accepted Date: 28 June 2018

Please cite this article as: Lee, E.-H., Stoughton, T.B., Yoon, J.W., Kinematic hardening model considering directional hardening response, *International Journal of Plasticity* (2018), doi: 10.1016/j.ijplas.2018.06.013.

Kinematic hardening model considering directional hardening response

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Abstract

This paper proposes a kinematic hardening model to capture both asymmetric plastic behavior (early-reyielding, transient Bauschinger effect and permanent softening) and directional hardening (anisotropic hardening) response at the same time. The previously reported kinematic hardening models have brought significant improvements of ability to describe the asymmetric plastic behavior of sheet metal in cycling loading conditions at fixed one angle from the rolling direction (RD). However, their inability to cover the anisotropy in the directional hardening response has a limitation to describe the anisotropic hardening behavior because material constants of general kinematic hardening models are only fitted to one reference axis. In order to capture the anisotropic hardening with a kinematic hardening model, this work proposes a scheme to combine a kinematic hardening model with a function, which is called the condition function in this paper, to account for the change of the mechanical property with respect to the rolling direction. The condition function should explicitly capture four independent hardening data in different directions, 0°, 45°, 90° to the