

This command is used to construct an IMKBilin material. This material simulates the modified Ibarra-Medina-Krawinkler deterioration model with bi-linear hysteretic response (Ibarra et al. 2005; Lignos and Krawinkler 2011).

Command Syntax:

uniaxialMaterial IMKBilin \$Mat_Tag \$Ke \$Up_pos \$Upc_pos \$Uu_pos \$Fy_pos \$FmaxFy_pos \$FresFy_pos \$Up_neg \$Upc_neg \$Uu_neg \$Fy_neg \$FmaxFy_neg \$FresFy_neg \$Lamda_S \$Lamda_C \$Lamda_K \$c_S \$c_C \$c_K \$D_pos \$D_neg

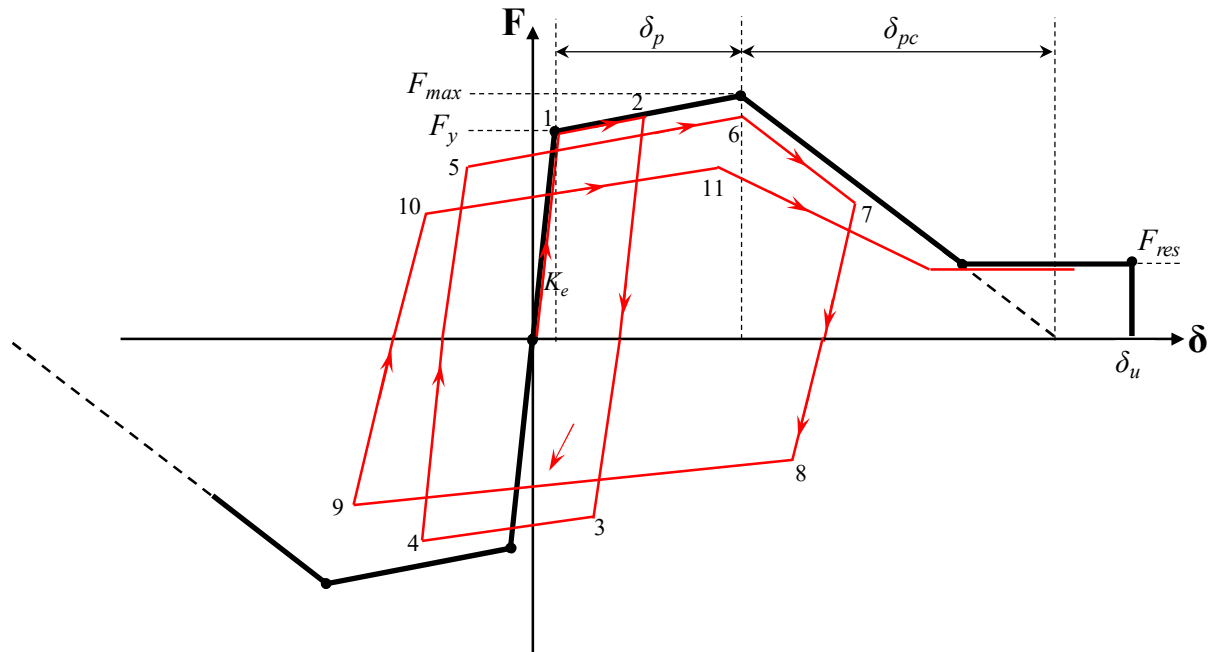
Model Parameters Definitions:

\$Mat_Tag	Integer identifying the material
\$Ke	Elastic stiffness
\$Up_pos	Pre-capping deformation in positive loading direction
\$Upc_pos	Post-capping deformation in positive loading direction
\$Uu_pos	Ultimate deformation in positive loading direction
\$Fy_pos	Yield strength in positive loading direction
\$FmaxFy_pos	Maximum-to-yield strength ratio in positive loading direction
\$FresFy_pos	Residual-to-yield strength ratio in positive loading direction
\$Up_neg	Pre-capping deformation in negative loading direction
\$Upc_neg	Post-capping deformation in negative loading direction
\$Uu_neg	Ultimate deformation in negative loading direction
\$Fy_neg	Yield strength in negative loading direction
\$FmaxFy_neg	Maximum-to-yield strength ratio in negative loading direction
\$FresFy_neg	Residual-to-yield strength ratio in negative loading direction
\$Lamda_S	Cyclic deterioration parameter for yield strength deterioration
\$Lamda_C	Cyclic deterioration parameter for post-capping stiffness deterioration
\$Lamda_K	Cyclic deterioration parameter for unloading stiffness deterioration
\$c_S	Rate of yield strength deterioration
\$c_C	Rate of post-capping stiffness deterioration
\$c_K	Rate of unloading stiffness deterioration
\$D_pos	rate of cyclic deterioration in the positive loading direction (this parameter is used to create asymmetric hysteretic behavior for the case of a composite beam). For symmetric hysteretic response use 1.0.

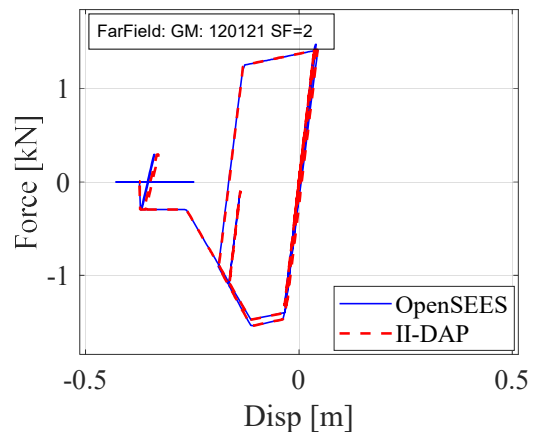
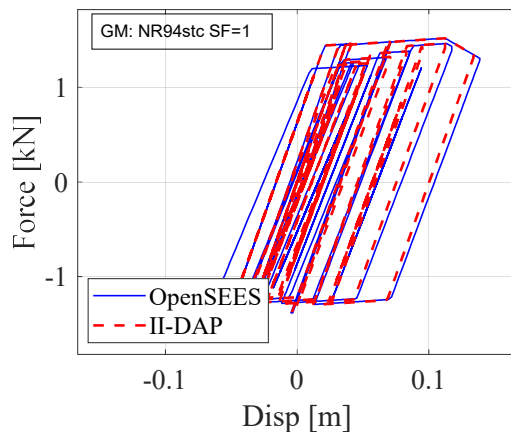
$\$D_neg$

rate of cyclic deterioration in the negative loading direction (this parameter is used to create asymmetric hysteretic behavior for the case of a composite beam). For symmetric hysteretic response use 1.0.

NOTE: All material model parameters in the negative direction should be specified in positive values.



Validation with II-DAP:



References:

Ibarra, L. F., Medina, R. A., and Krawinkler, H. (2005). "Hysteretic models that incorporate strength and stiffness deterioration." *Earthquake Engineering & Structural Dynamics*, 34(12), 1489-1511, Doi: 10.1002/eqe.495.

Lignos, D. G., and Krawinkler, H. (2011). "Deterioration modeling of steel components in support of collapse prediction of steel moment frames under earthquake loading." *Journal of Structural Engineering*, 137(11), 1291-1302, Doi: 10.1061/(ASCE)ST.1943-541X.0000376.