به نام خداوند جان و خرد

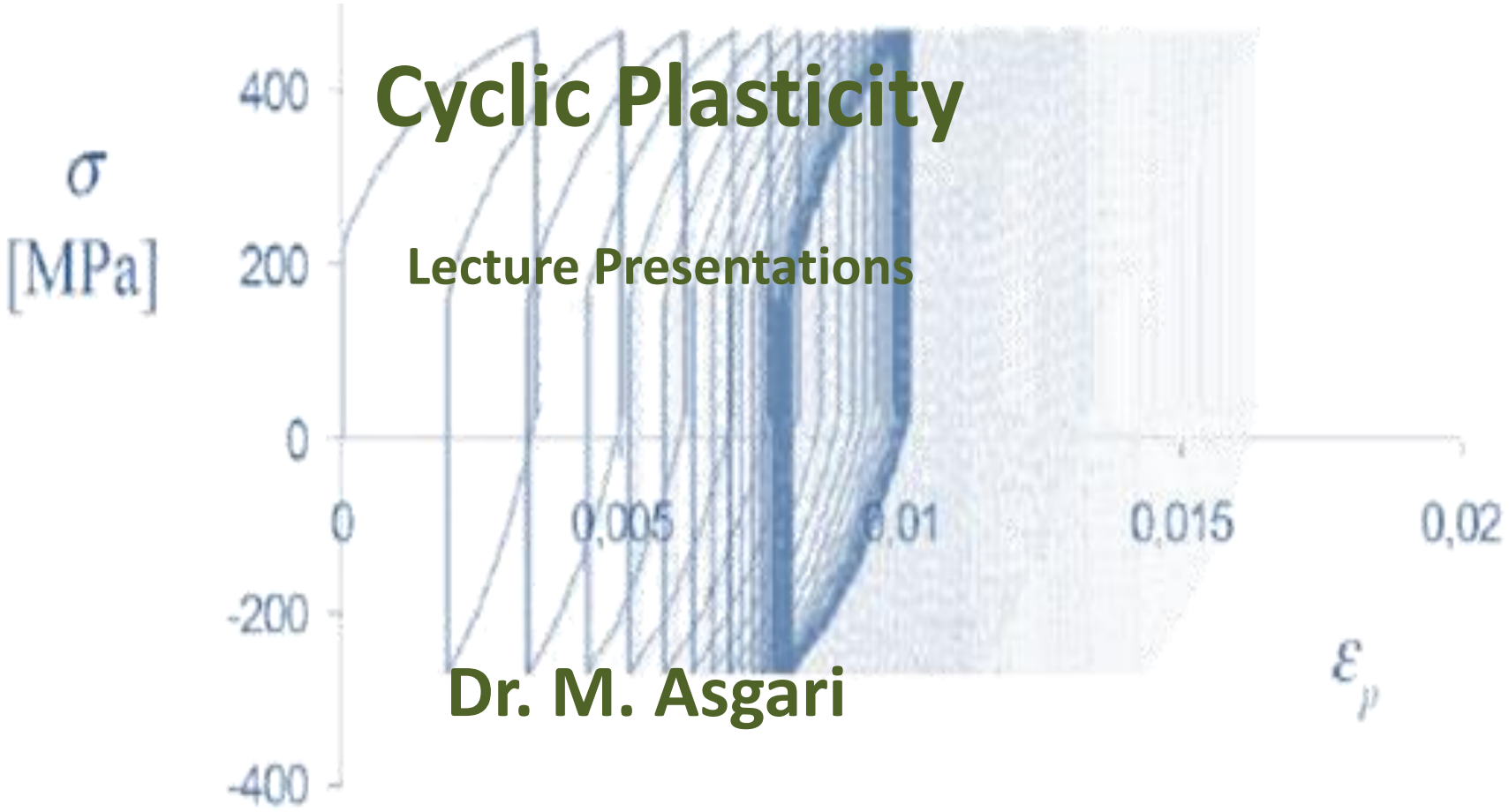
کزین برتر اندیشه برنگذرد

دانشگاه صنعتی خواجه نصیرالدین طوسی

K. N. Toosi Univ. of Technology,
Faculty of Mechanical Engineering

Cyclic Plasticity

Lecture Presentations



Dr. M. Asgari

Cyclic Controlled Loading

Fig. 1

strain controlled loading:

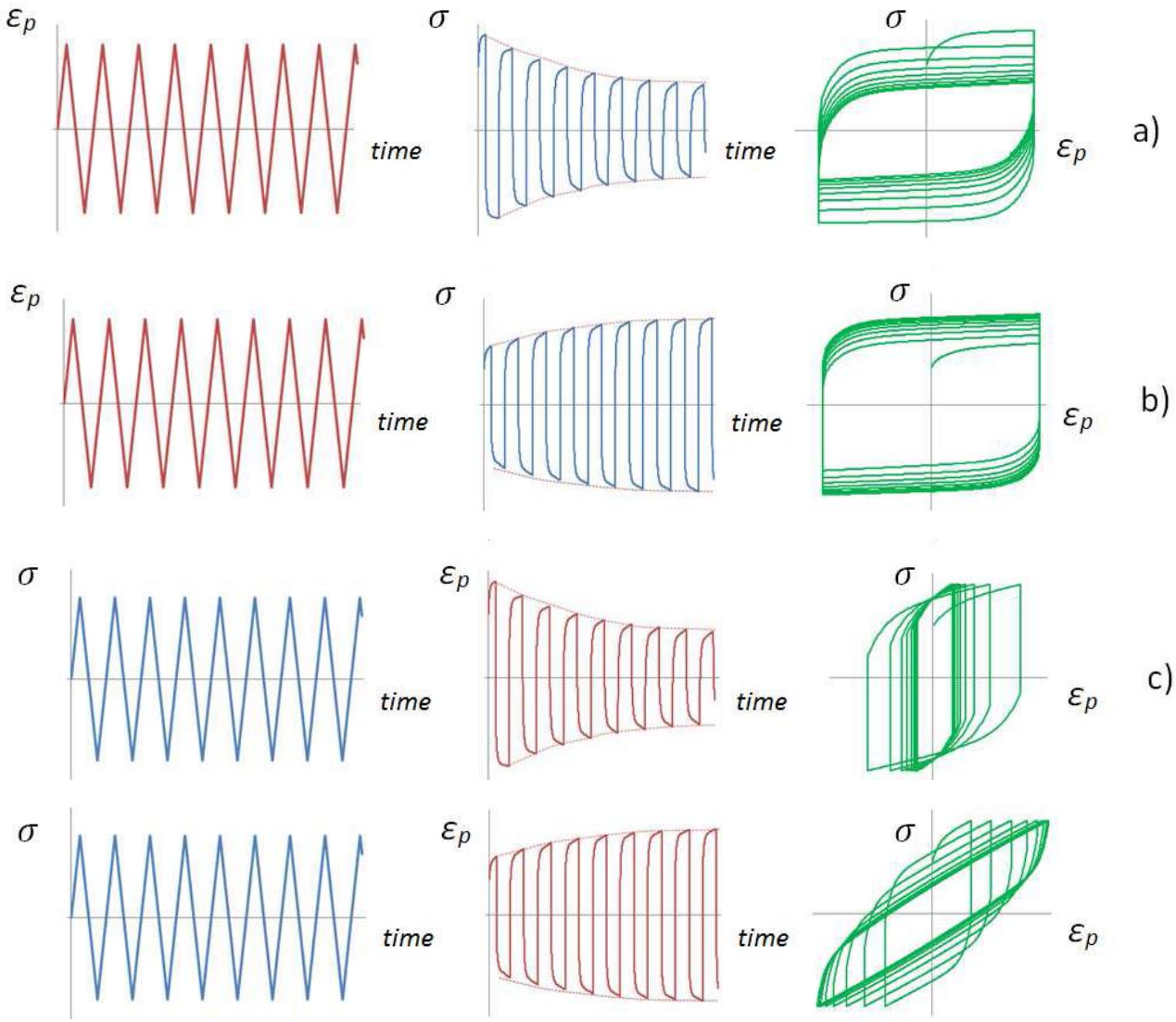
- Cyclic Softening

- Cyclic Hardening

stress controlled loading:

- Cyclic Hardening

- Cyclic Softening



Ratcheting

Scheme of uniaxial ratcheting and influence of hardening/softening behaviour.

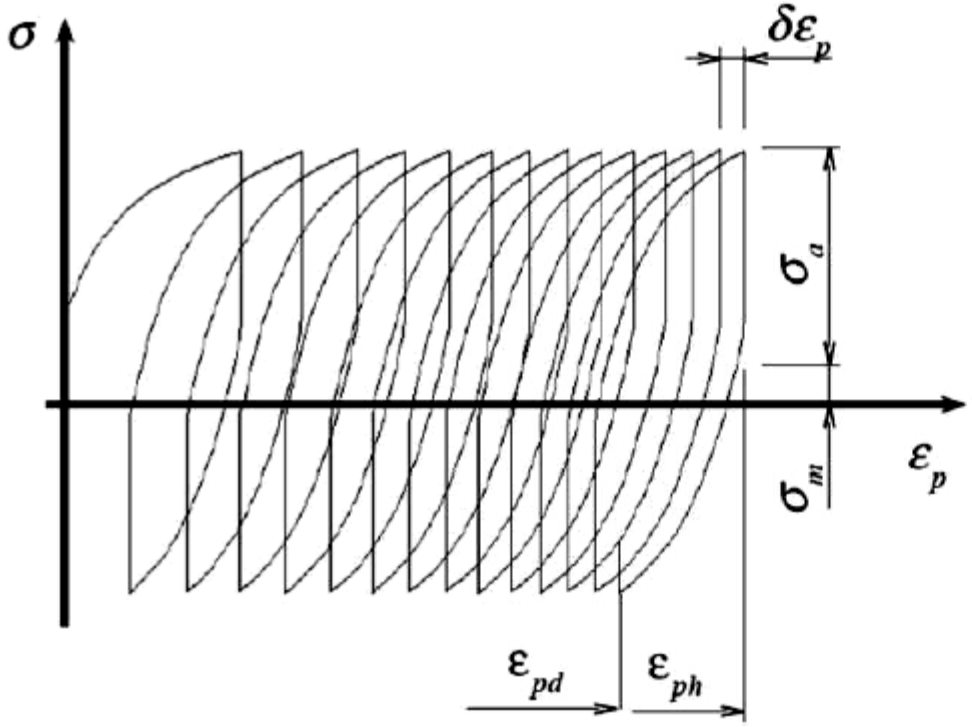


Fig. 2

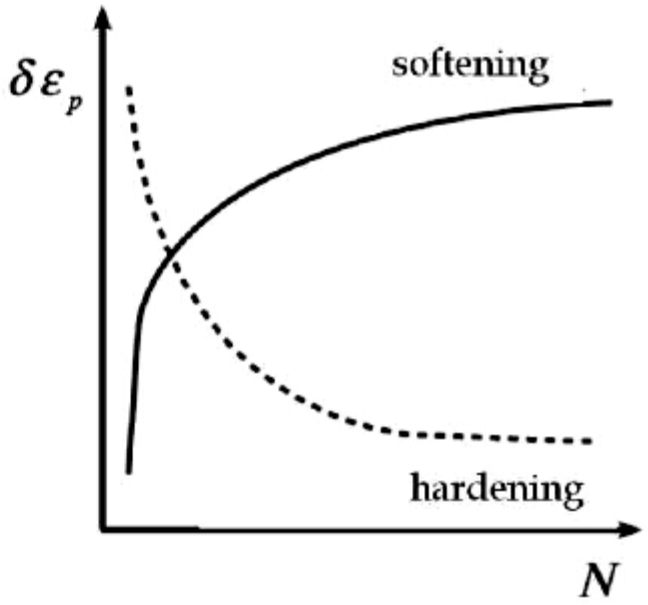


Fig. 3

Ratcheting and Shakedown

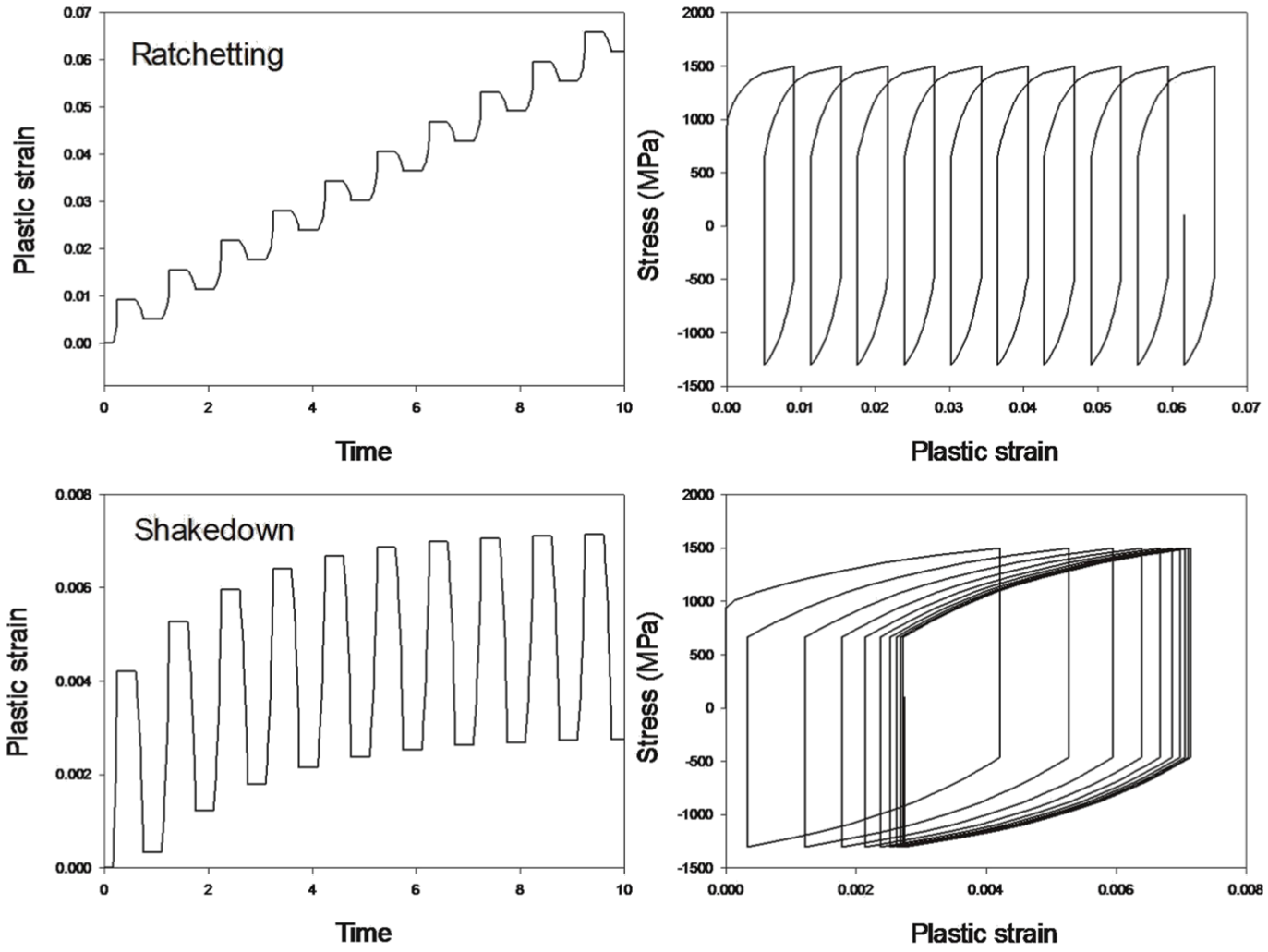


Fig. 4

Cyclic stress-strain curve of ST52 steel.

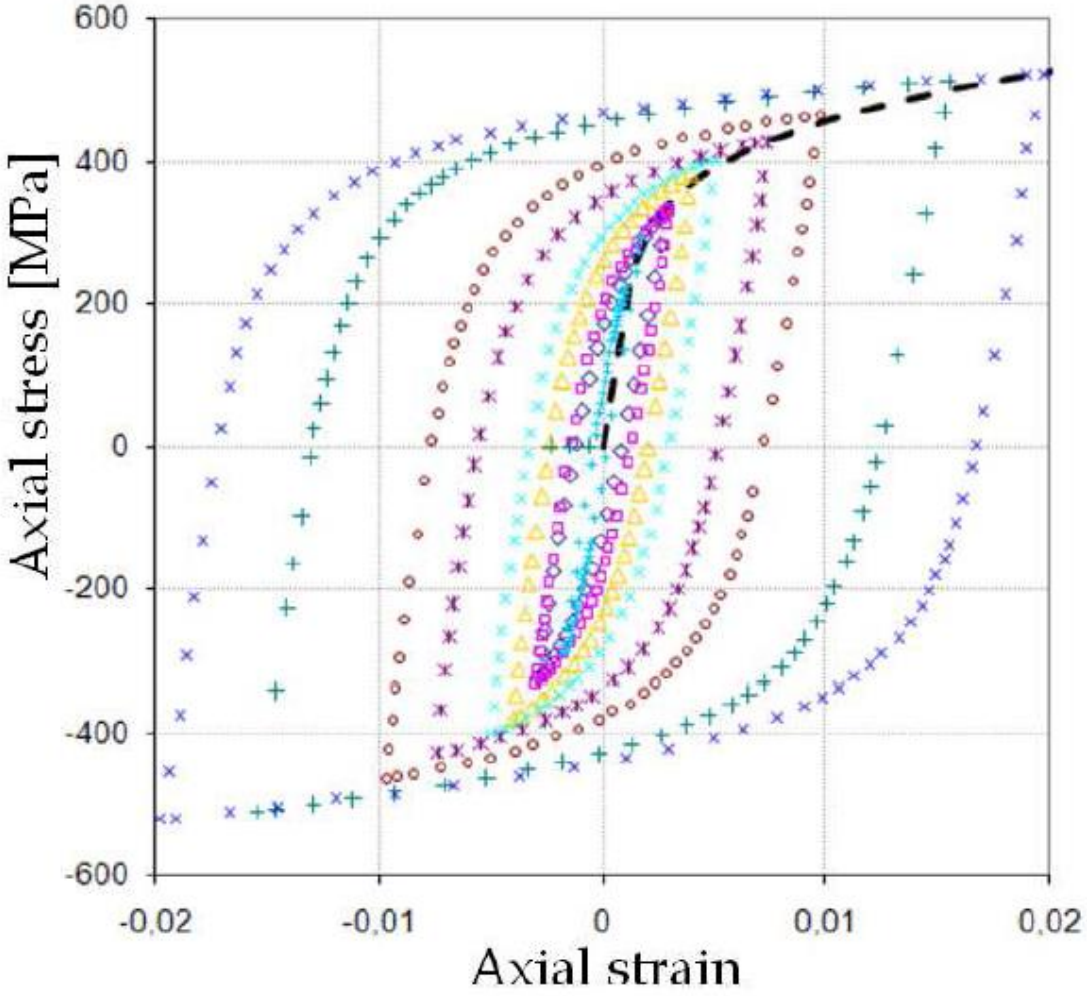


Fig. 5

Masing Behaviour

representation of Masing Behaviour

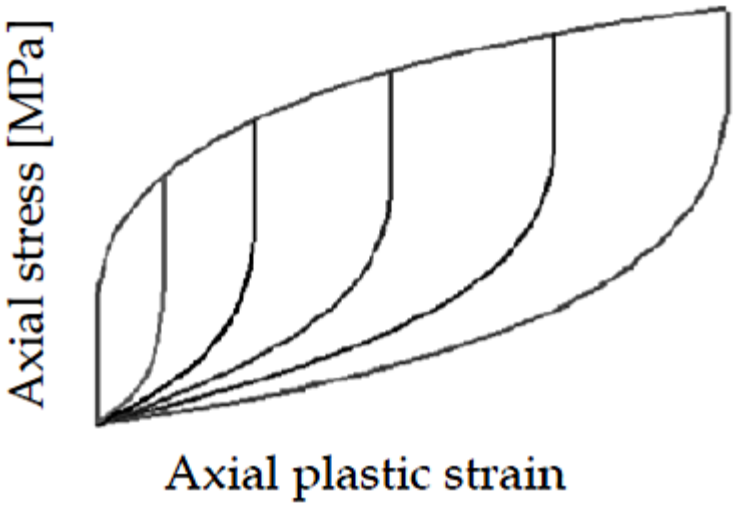


Fig. 6

Non-Masing's Behaviour of ST52 steel

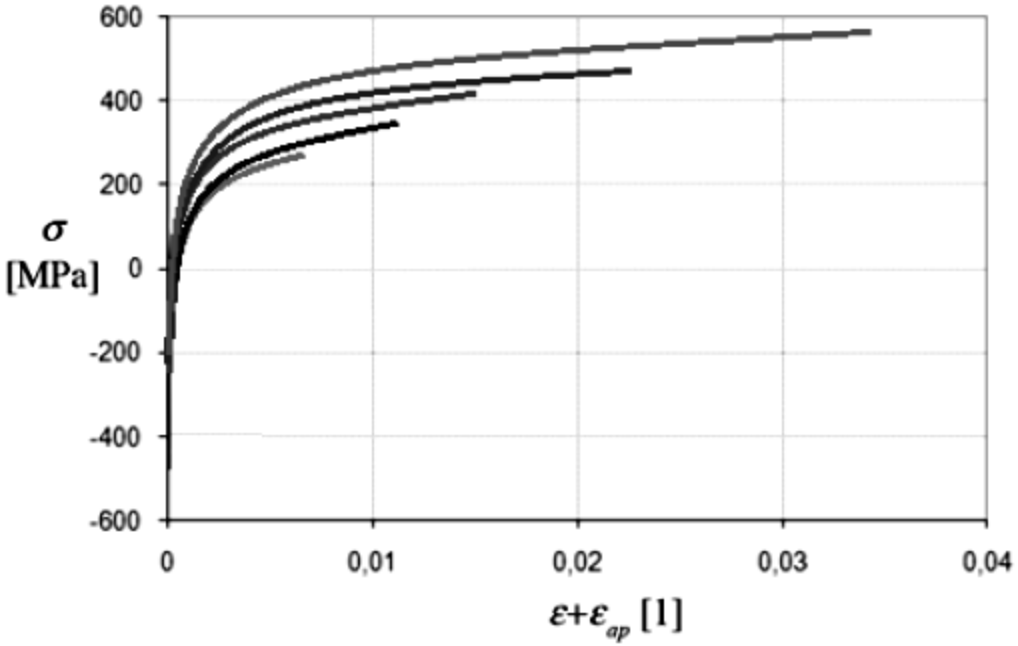


Fig. 7

Stress Relaxation

Mean stress relaxation under nonsymmetric strain cycles

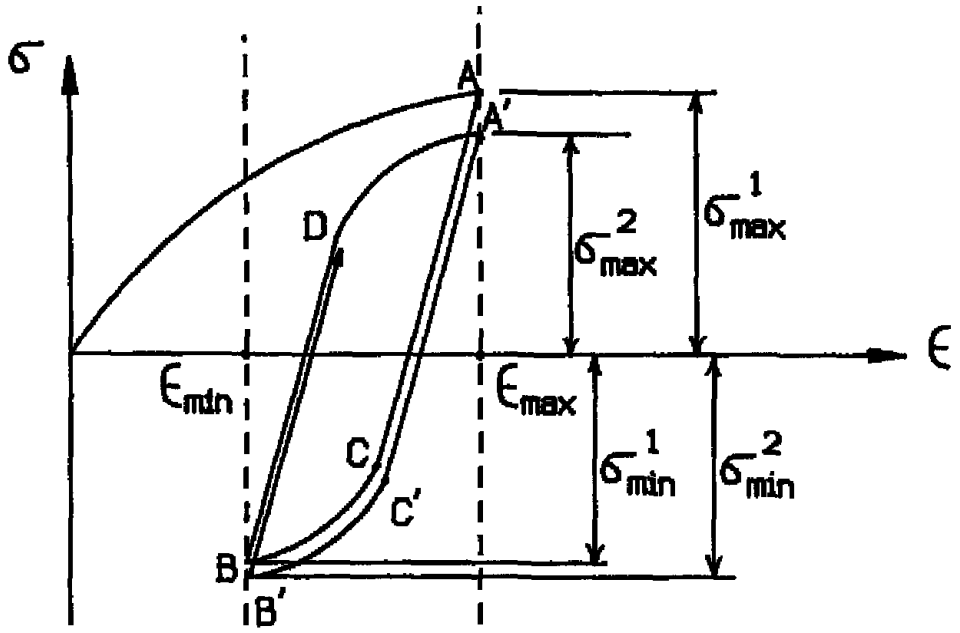
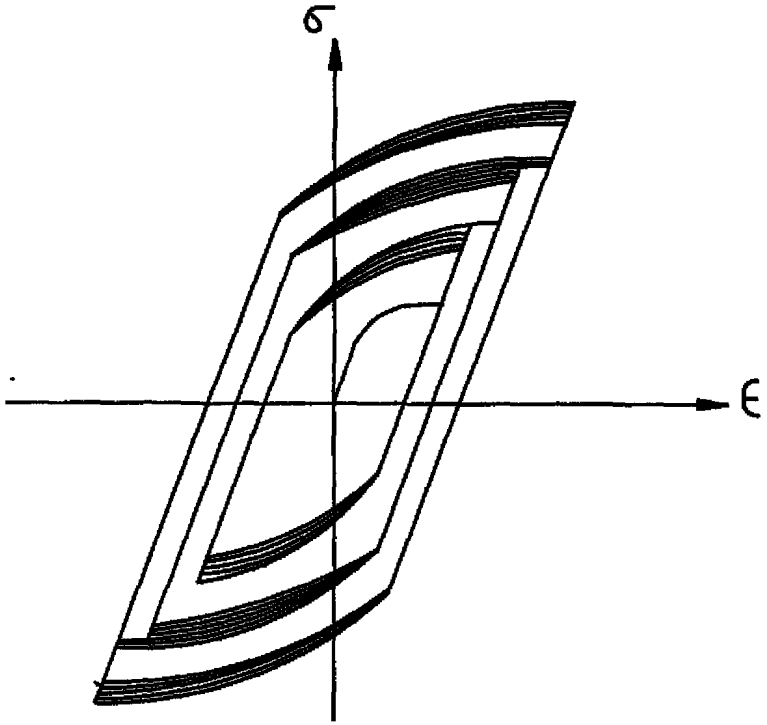


Fig. 8



Controlled strain testing on 316 L steel at 20°C, (Chaboche 1979)

Fig. 9

mixed hardening

Von Mises yield function with mixed hardening in the deviatoric plane

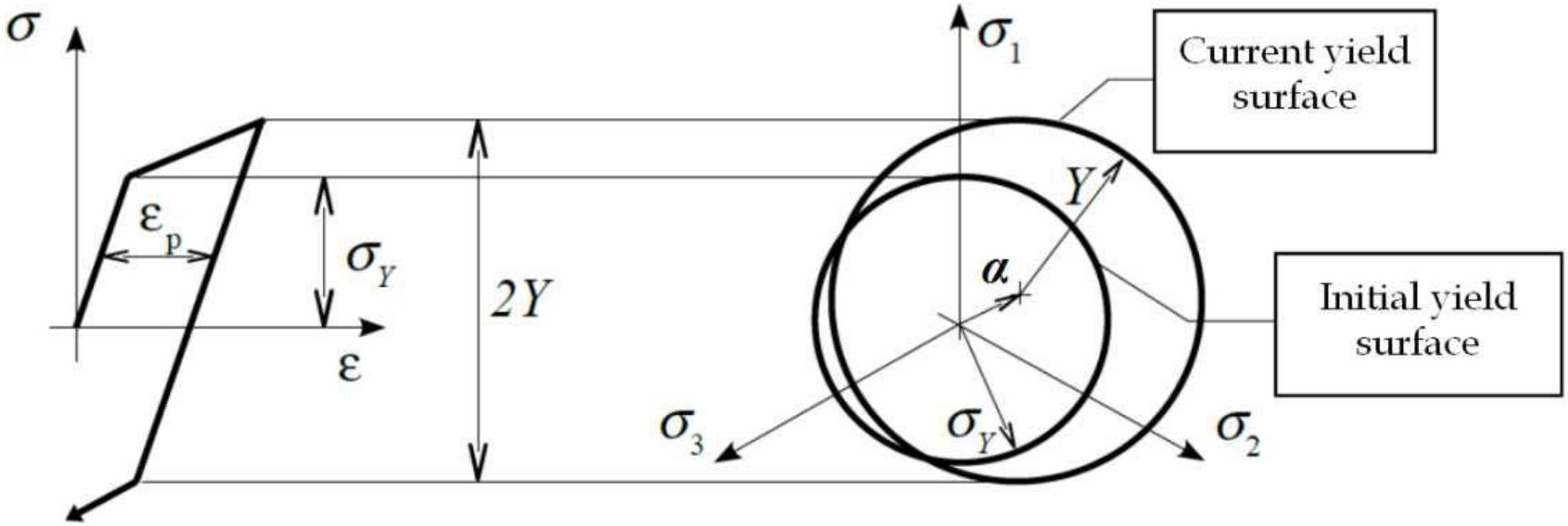


Fig.10

hardening Models

Isotropic hardening Model

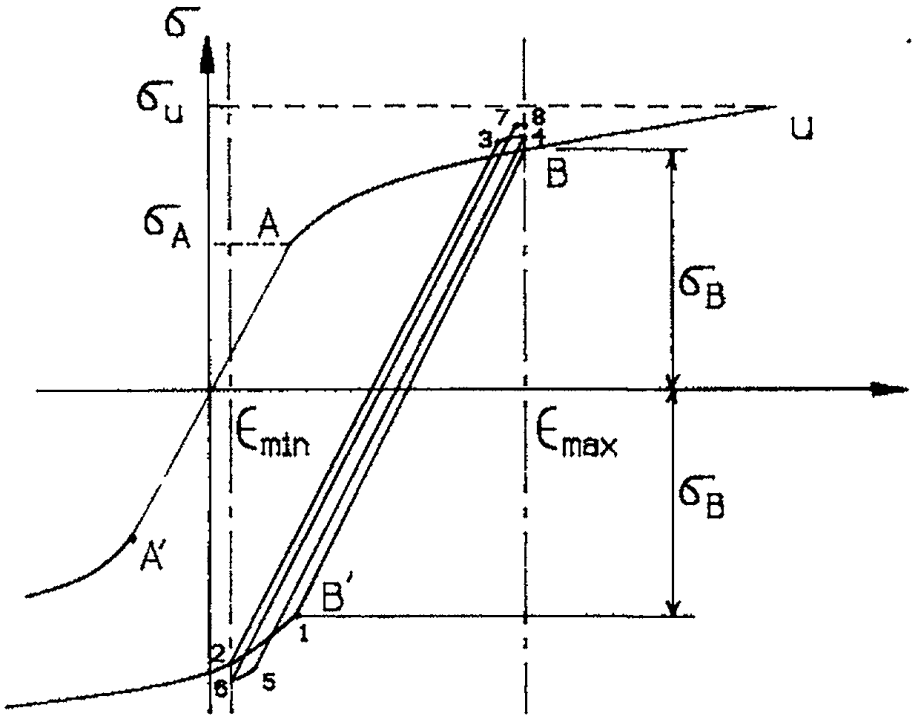


Fig. 11

Linear Kinematic hardening Model

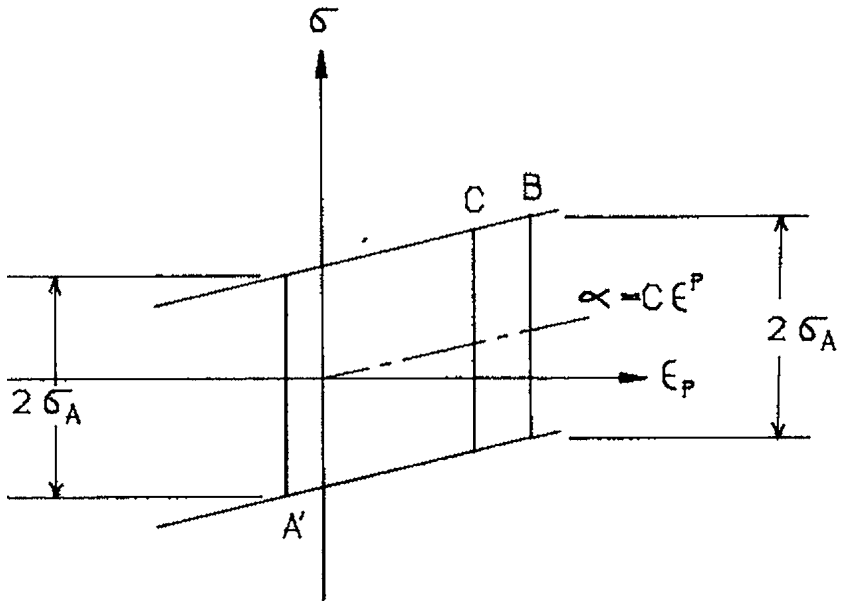


Fig. 12

hardening Models

Mroz approximation Model

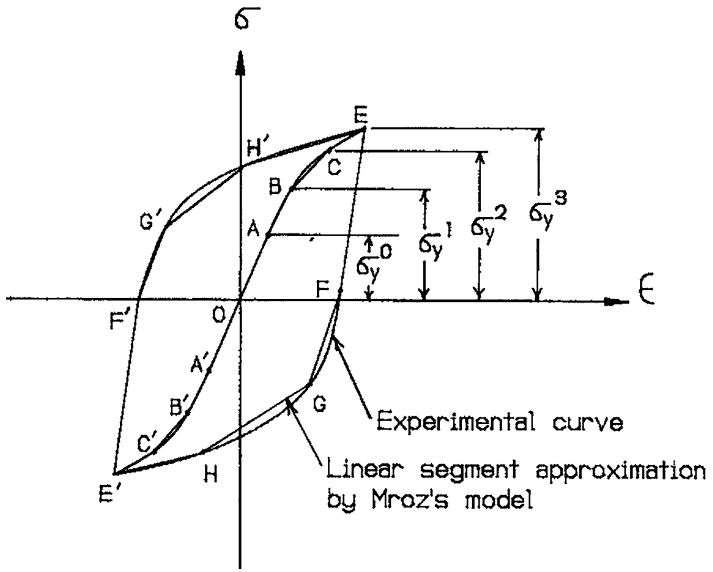


Fig. 13

General Multi-surfaces Model

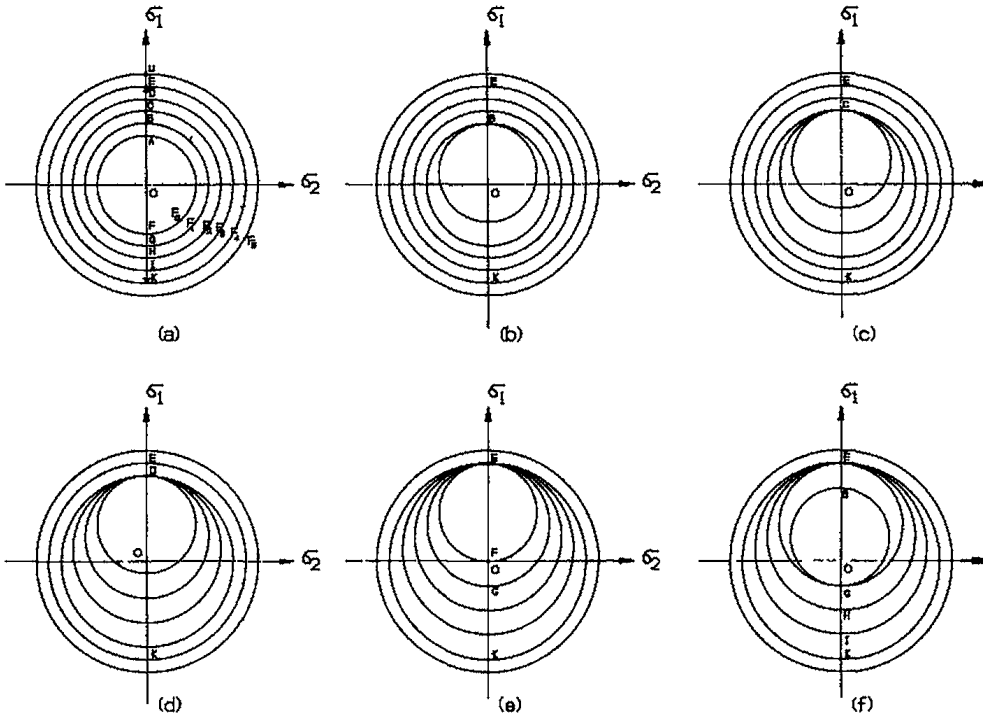


Fig. 14

hardening Models

nonlinear kinematic hardening model of Armstrong/Frederick

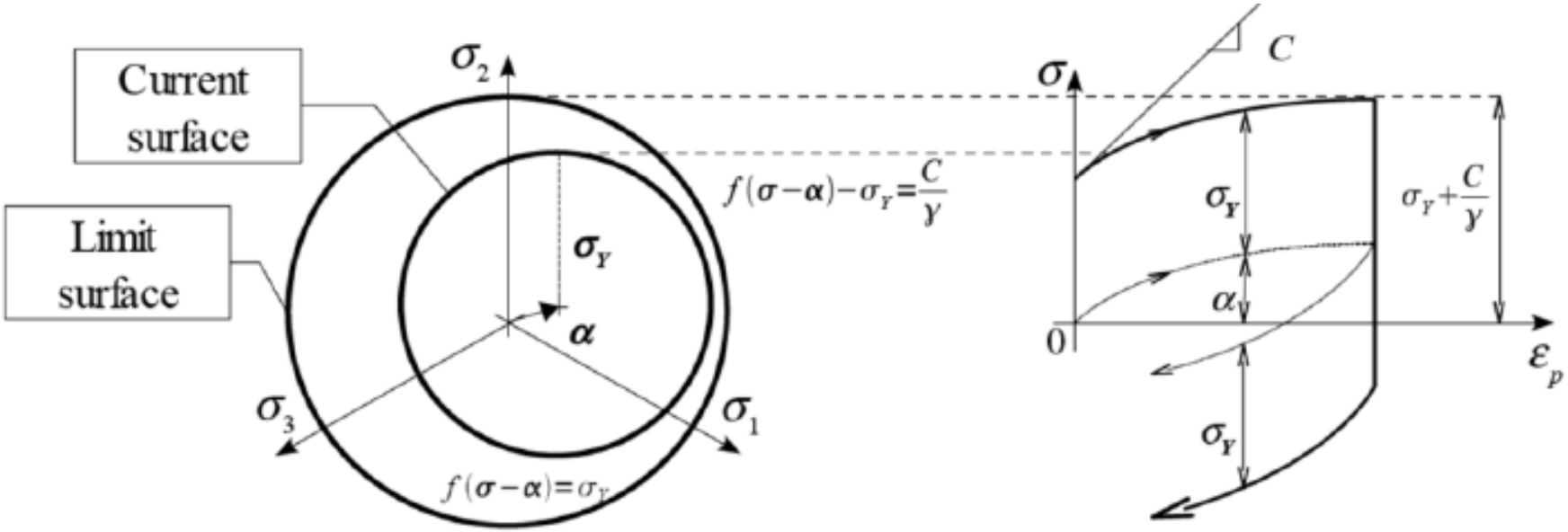


Fig. 15

hardening Models

hysteresis loop to identify parameters of Chaboche model

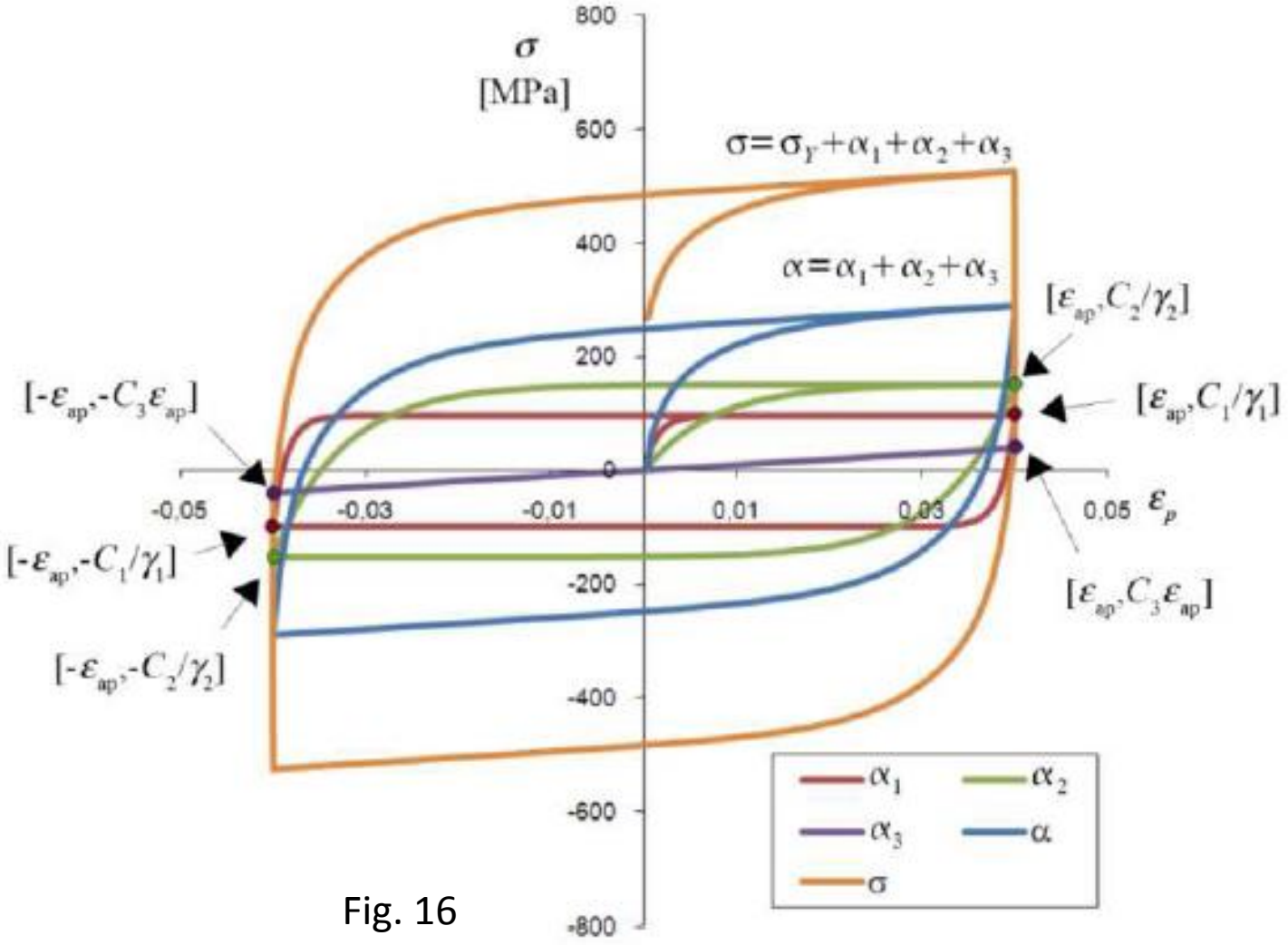


Fig. 16

hardening Models

Influence of parameter *γ2 on ratcheting response of the Chaboche model (M=2).*

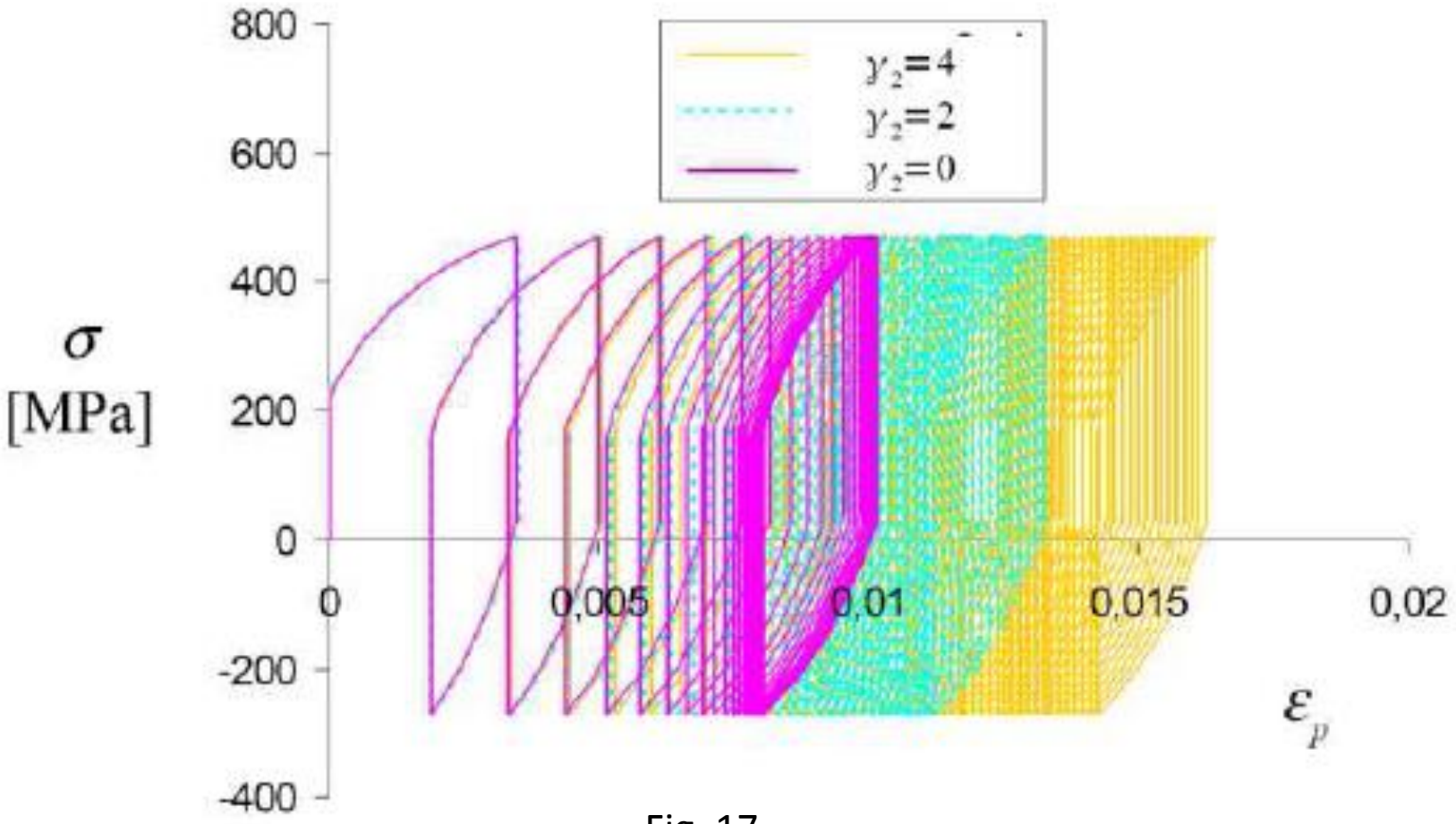


Fig. 17

hardening Models

Occurrence of cyclic plasticity models in some popular FE software

Kinematic hardening	Ansys 13	Abaqus	MSC.Marc	MSC. Nastran
Bilinear	x (Prager)	x	x (Ziegler)	x (Ziegler)
Multilinear	x (Besseling)	-	-	-
Armstrong-Frederick	x	x	x	x
Chaboche	x (M_{max}=5)	x (M_{max}=3)	-	-

References:

- Akhtar S. Khan, S. Huang, ***Continuum Theory of Plasticity***, John Wiley and Sons, 1995.
- Peep Miidla, ***Numerical Modelling***, 2012, InTech Publication.
- Marcio Costa Araújo , ***NON-LINEAR KINEMATIC HARDENING MODEL FOR MULTIAXIAL CYCLIC PLASTICITY, 2002*****,*** Universidade Federal do Piauí, Brazil.
- Koichi Hashiguchi, **Elastoplasticity Theory, 2009, Springer,**

"You cannot depend on your eyes when your imagination is out of focus."

Mark Twain