An adaptive design method for understanding tolerance

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Modern Mechanics and School

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Order from noise

Prigogine (Brussels)

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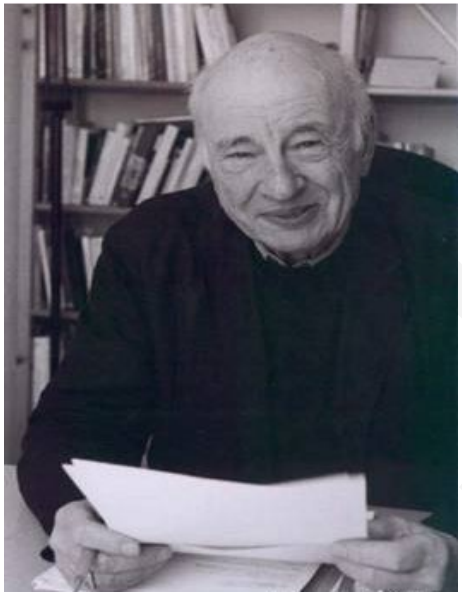
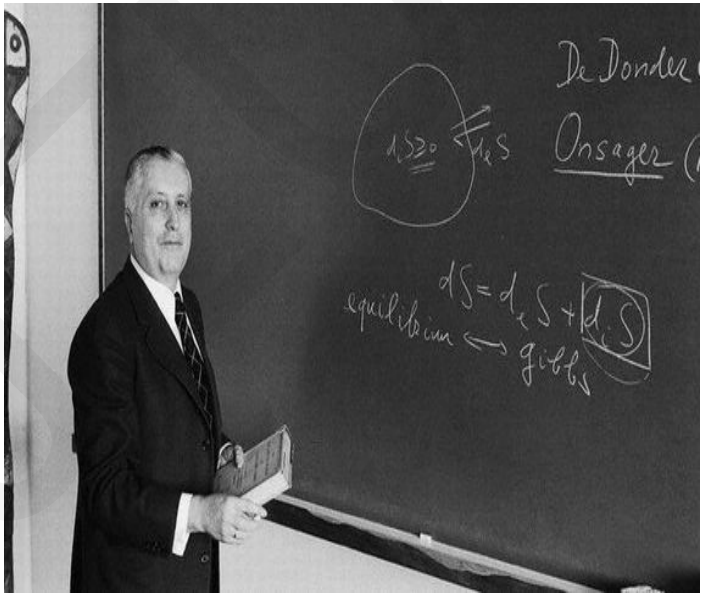
Simplicity and adaptability





Condition Mechanics

Plastic deformation

Stamping trials

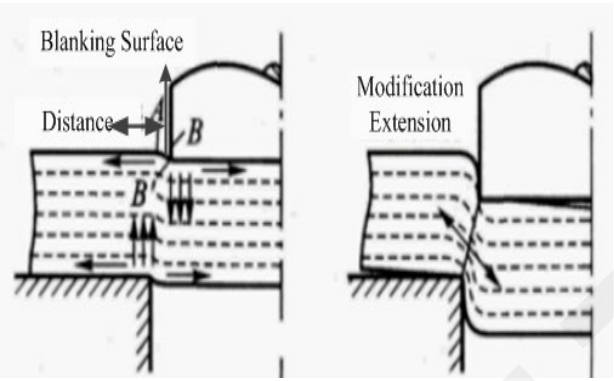


Fig. 1 Plastic deformation of metallic materials

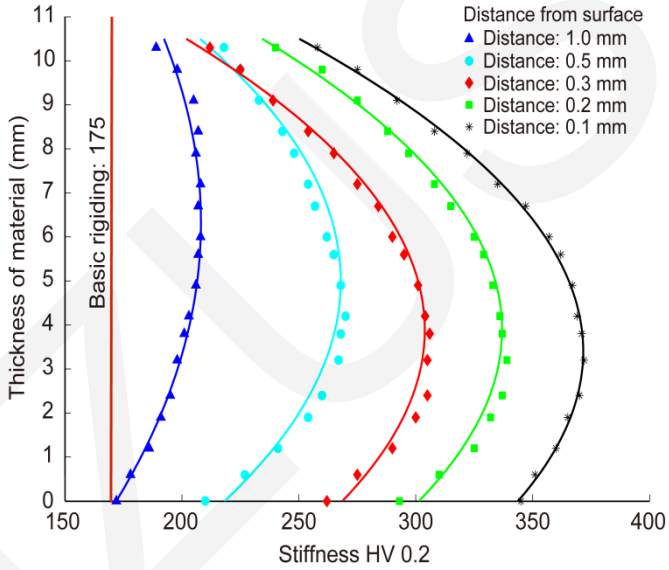


Fig. 2 Hardening state Curves of Q345

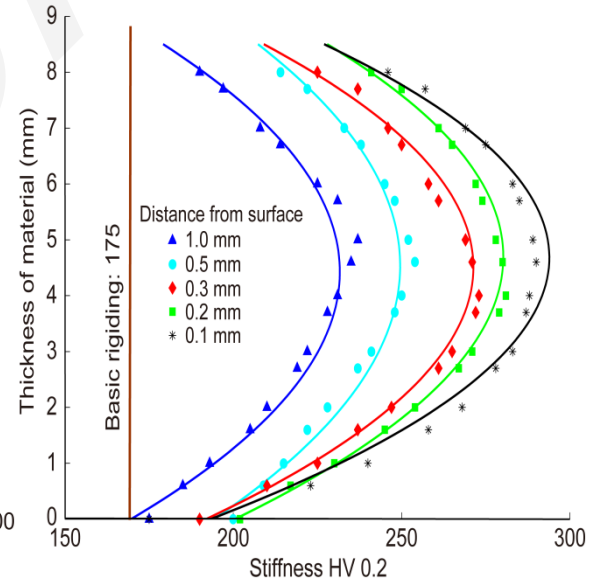


Fig. 3 Hardening state Curves of 35#

the hardening state curves of the different materials were different. And under the same distance, the values of the hardening state of different materials were different. Stiffness presents the physical parameter of pressure in the stamping process.

The stamping process

Mechanics Simulation

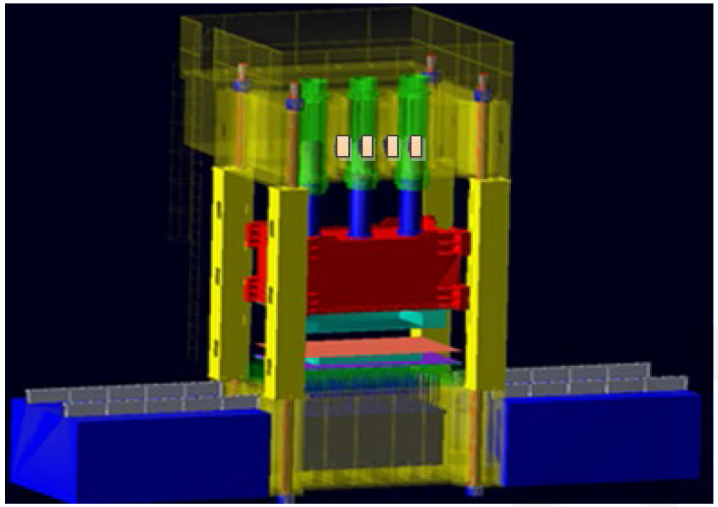


Fig.3. Three-dimensional model of stamping equipment

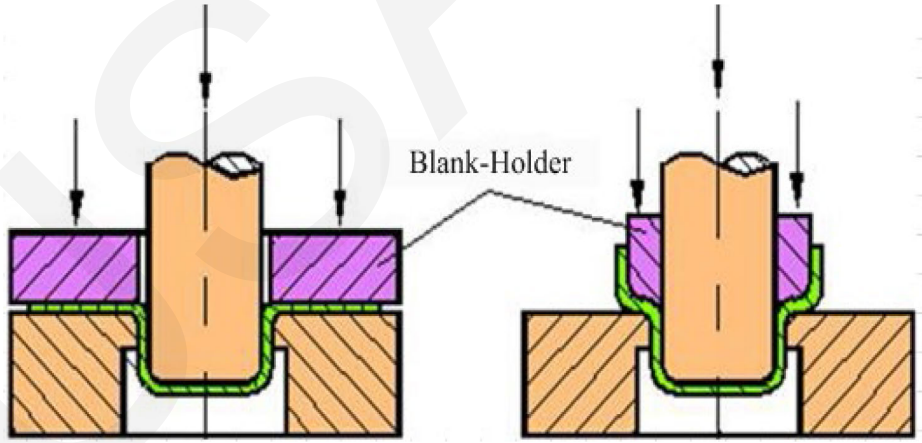
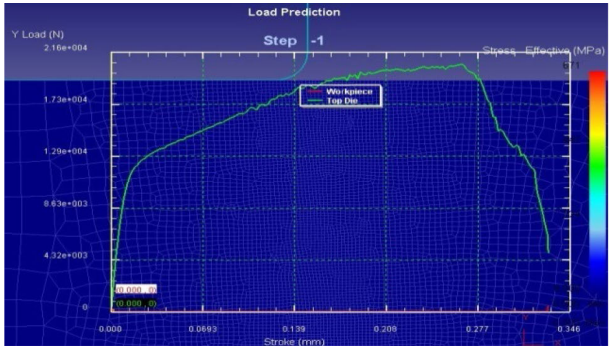


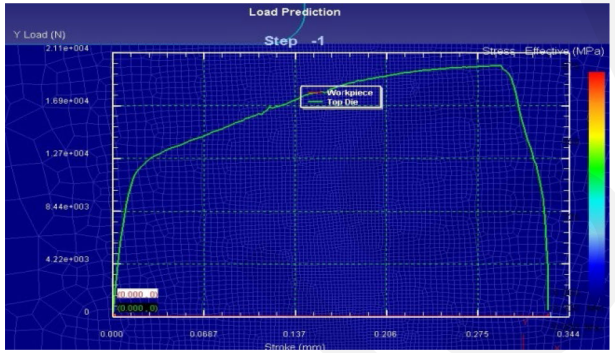
Fig.4. Partial simulation in stamping process

The compound die mainly includes blanking die, punch-die, drawing punch and the blank holder ring parts.

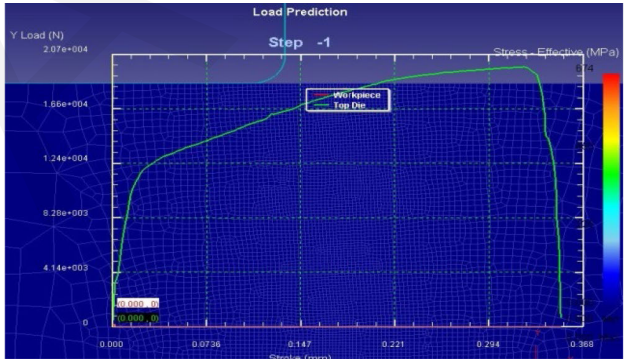
Results of Five states experiments



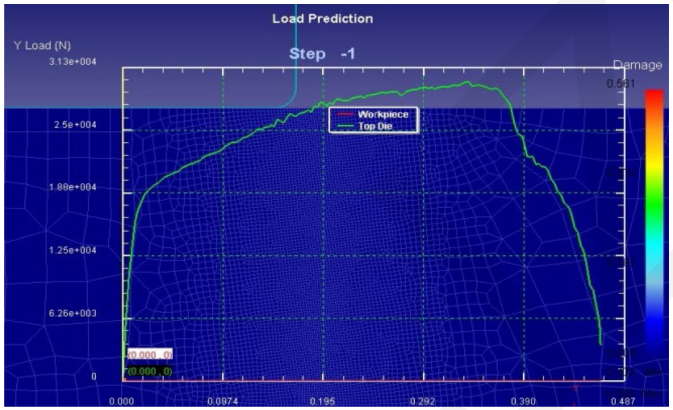
(a) Simulation of adaptive control in S1



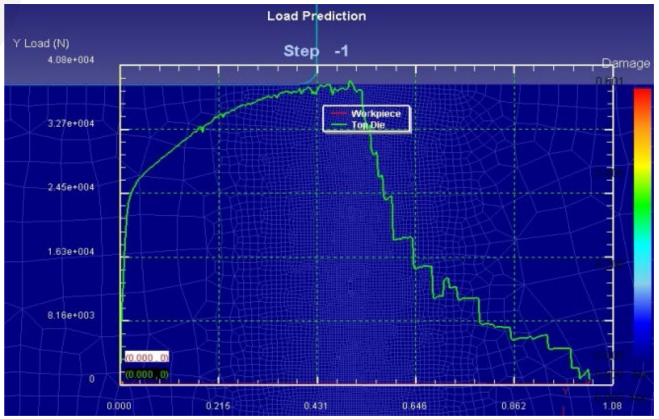
(a) Simulation of adaptive control in S2



(a) Simulation of adaptive control in S3



(a) Simulation of adaptive control in S4



(a) Simulation of adaptive control in S5

•Fig. 5 Simulation of the experiments in 5 states

Conclusions

- Stamping experiments were conducted in two kinds of steel materials (Q345 and 35 #) to study the hardening state. And the conclusion is found out that the average curvatures of hardening state curves of the material forming are different with different distances to the precision stamping surface when the load stress exceeded the proff stress.
- The sequence of the hidden tolerance fluctuant states in the precision stamping process at each time can be obtained by using the HMM algorithm.
- The adaptive design of the tolerance fluctuations is simulated and analyzed by the precision stamping process through controlling the process parameters, such as pressure of the hydraulic press, displacement of molds, distance of the fracture in materials, and so on.