Dynamic model for Electrode force in Resistance spot welding machines

S.A.Shah*, Furqan Ahmad*, Sun-Nyu Jeong, Hee S. chang***.**

*Myongji International Graduate School

**Myongji University Graduate School, Yongin, Korea

*** Myongji University, Department of Mechanical Engineering

ABSTRACT

Despites it desirable qualities it is very difficult to control which raises concerns about quality of resistance spot welds. Uncertainties about quality are responsible for the practice of making more spot welds than are needed for maintaining structural integrity. An optimum set of welding parameters must be defined to produce the properties desired of the weld. Dynamic electrode force and displacement, both, being responses to nugget formation and growth, are two important parameters to monitor. Second is the control implementation to maintain process variables within necessary ranges to that optimized welds can reproducibly be made It has been realized that mechanical properties may be of even greater importance that electrical ones. However due to complexity of the machine structure and mutual couplings of machine system it is very difficult to measure machine mechanical parameters. The electrode force is affected by thermal and metallurgical factors but the vibration due to these force changes is related with basic mechanical parameters. A dynamic model characterizing electrode force and displacement was designed; an experimental setup was developed to determine the mechanical properties which govern the dynamic mechanical response of the Resistance Spot Welding Machine. During the test different levels of load were applied, acceleration and displacement for each level of load was measured by accelerometer and gape sensor. A lumped-mass damped vibratory unit was adopted. It was seen that machine behaved dynamically as damped vibration. A less difference in equivalent mass *m* can be seen at different loads. The investigation was aimed at electrode displacement when there is interaction of forces. Dynamic models of the weld head would also allow an improved quantitative understanding of welding machine characteristics useful for subsequent design improvements. The acceleration and amplitude got increased with increase of electrode force level. A much scatter is observed in the equivalent spring constant *k* in the graph for different levels of loadings. Model was verified by the simulation of electrode dynamics with the objective of calculating electrode displacement from the electrode force data measured from experiment. The experimental displacement curves and calculated displacement curves both agreed well.

Key Words： Load cell, gape sensor, accelerometer