

Transient simulation of Electromagnetic Forming of Aluminium Tubes

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Abstract. The recent push to use more aluminium in automobiles has stimulated interest in understanding electromagnetic forming (EMF), which uses induced electromagnetic fields to generate high strain rates during the forming process. The high strain rates increase the formability of aluminum materials and might reduce elastic spring-back and wrinkling of the workpiece. Primary emphasis is placed on including of all relevant physical phenomena, which govern the process, as well as their numerical representation by means of simplified electrical equivalent circuits for the EMF machine and fully coupled field approach of the transient electromagnetic and mechanical phenomena. Moreover, the thermal effects due to Joule heating by eddy currents and plastic work are considered. The numerical model predicts the electromagnetic field, temperature, stress, and deformation properties that occur during the forming process. The numerical results of the tube deformation are compared with available experimental data.