2009 Final Year Projects
Advanced Materials and Modeling Techniques

ANALYTICAL – EXPERIMENTAL INVESTIGATIONS OF COLD CONICAL SPIRAL EXTRUSION

The problem:
Extrusion is a process used to create objects of a fixed cross-sectional profile. A material is pushed or drawn through a die of the desired cross-section. The two main advantages of this process over other manufacturing processes are its ability to create very complex cross-sections and work materials that are brittle, because no tensile is produced, which makes high deformation possible without tearing the metal. It also forms finished parts with an excellent surface finish. Extrusion is done by squeezing metal in a closed cavity through a tool, known as a die using either a mechanical or hydraulic press.

Spiral extrusion is an interesting process which can provide a combination of both compression and shear at the same time. This could be an advantage for material property improvement.

Estimation of loads during this process is of interest during this project.

This is a group project and requires 3-4 students, S1, S2, S3 and S4.

The project:

a) Prerequisites
- Good background in mathematics (S1)
- Good background in mechanics of solids (S1, S3 and S4)
- A good knowledge of computer programming (S1)
- Familiar with NX CAD software (S2, S3 and S4)
- Familiar with a commercial finite element software (S3 and S4)

b) Expected output
- Runge-Kutta solution of conical spiral extrusion by slab method with adaptive step size control (S1)
- The proposed method requires Numerical solution of an ordinary non linear differential equation of pressure distribution in conical spiral extrusion obtained from the slab method. (The differential equations are of first order and non linear) (S1)
- Computer programming for the solution or using a commercial finite element software (S1 or S3 and S4)
- Comparison of the results with some experimental data and some simplified solutions of the problem. (S2)

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