1 General

A project is required for successful completion of this course. It will be a team effort. Teams should have no more than 2 members. The project problem will vary from team to team. It should be chosen in consultation with the instructor. The project can originate from a work-related problem or it could be a modified version of a problem reported in the literature. A problem derived from the literature should primarily come from technical journals such as the ASME Journal of Manufacturing Science and Engineering or the Journal of Materials Processing Technology. This is not an exhaustive list. If you have difficulty identifying a suitable problem, please contact the instructor. Sample project problems are described below.

The thrust of this exercise (project) is to use LS-DYNA (or ABAQUS) to model and solve an appropriate materials processing problem. The results must be reported in two formats: oral and written. The oral presentation will be made in class on 4/29/04. Each team will have 15 minutes to present their problem and solution(s). The written report will be due a week later (5/6/04). The format for the written report is provided below.

2 Sample Project Problems

1. Bending of sheet metal is a common manufacturing operation. It is frequently used in the automotive and aerospace industry. Springback is a material phenomenon that affects the final shape of the bent product. Predicting and accounting for springback is an important design aspect of a bending process. The magnitude of springback is influenced by a number of material variables such as elastic modulus, yield strength, anisotropy etc. This project will study the influence of these material parameters on the springback in the bending of a U-cross section. Simulations will be performed using the LS-Dyna finite element program.

2. Rolling is an operation performed to reduce the section height of billets. This is done by passing the billet through a gap between two counter rotating rolls. Of interest to a process designer is the force and torque requirements on the rolls. This is a function of the roll gap, roll radius, reduction, and material properties. This project will involve a parametric study of the process using the finite element method and a comparison with results obtained from other approximate techniques such as the slab method.
3. In backward extrusion, the motion of the work material is opposite in direction to that of the punch. This is a useful method for making hollow, symmetric components. The extrusion force is dependent on the change in section size, friction coefficient, and material properties. Approximate solutions are available from slip line field analysis for this force. This study will seek to compare the results of these solutions with a finite element analysis.

3 Written Report Format

The following format is recommended for the report.

- Problem Description
- 'History'
- Objectives of project
- Methodology
- Results/Discussion/Conclusions.
- References
- Appendices
- Statement of Individual Contributions.

In addition, the report should contain a Cover page and a Table of Contents. Sections 1, 2, and 3 should provide the rationale for the project. The 'Problem Description' section should outline, in broad terms, the nature of the problem being studied. Section 2 ('History') should cover the methods/approaches that have been used in the past to deal with the problem, and how your project compares with them. The 'Objectives' section is an itemized list of goals. Sections 4 and 5 will comprise the bulk of the report. The methodology section should include a description of the assumptions, model(s), materials, parameters, methods/procedures etc. Section 5, as indicated, is the results section. Where possible, results should be presented in tabular/graphical format. Discussion of results is a crucial part of the report and due attention must be paid to this part. An itemized list of major conclusions will complete section 6. The 'Statement of Individual Contributions' should indicate clearly the contributions of each team member.

The report should be typed, single-spaced, on 8.5 X 11 sheets of paper. The main body of the report (sections 1 to 5) should not exceed 5 pages. Please do not clutter the body of the report with excessive graphs/figures. Graphs that are not absolutely essential in the body can be included in the appendices.