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OPTIMIZATION AND SIMULATION OF CREASING MACHINE- A REVIEW

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Abstract: Today's fast moving rapid world needed a higher production rate of any machine. The requirements are day b y day increasing and available resources are limited. Hence we need to use the existing systems and have to plan the production sequence to optimize the output. The present study focuses on the creasing behavior of corrugated sheets. To fold a board in a proper way, crease lines are applied to define the folding line and to reduce the necessary moment for folding. The purpose of this study is to understand and predict failure of corrugated sheet during the creasing process and increases the output. Cardboard boxes are industrially prefabricated boxes, primarily used for packaging goods and materials. Corrugated boxes are designed to be very strong. They are made of corrugated paperboard. The wavy paper inside the corrugated board is called the corrugating medium. The flat sheets on the outside are called liners. The model of existing machine is prepared by using PROE and the analysis being carried out using FEM software ANSYS for checking chances of improvement.

Keywords: Creasing machine, CAD, FEM, Creasers etc

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INTRODUCTION

We all know corrugated board as used in boxes, but its origin is surprisingly different. In the 19th century, hand-cranked corrugated roller presses were used to generate corrugated paper. Corrugated paper replaced the plain paper which was used to keep the shape of the tall, stiff hats worn by gentlemen. It is a machine which is used to crease the corrugated sheet and along that creased edges, the sheet is folded to make the box.

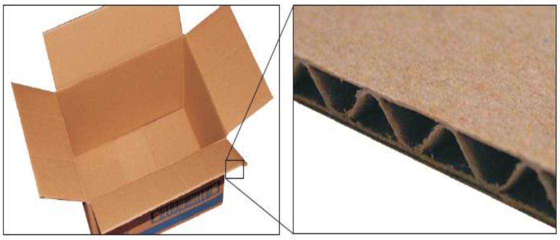


Figure 1.1 An example of a cardboard box at different scales

A creasing machine have upper and lower drum between which material to be cut is passed and being creased by the pattern of cutter. It consists of two rolls and 6 to 8 circular cutters. Creasing roll is attached by the belt, which drive these rolls. When the cutter rotates up & down then it creases the corrugated sheet box at the desired gap. The new cylinder was stronger than plain paper. Later, corrugated paper was first used to wrap bottles and slowly the first boxes were introduced. These boxes were much lighter and less expensive than the original ones made out of solid board. Nowadays, paper and paperboard are commonly used materials in nearly every industry. Worldwide about 300 million metric tons of paper and paperboard are produced each year. Probably the most important structural application is corrugated containers.

Figure 1.2 Creasing machine in industry

2.0 CORRUGATED BOARD

Corrugated board consists of one or several layers of corrugated paper which is glued on or in between plane sheets of paper as shown in figure 2.1. The manufacturing process can roughly be divided into two parts. The wet part, where the fluting is corrugated between two rolls and then glued onto the liner, shown in figure 2.2, and the dry part, where heat is applied to dry the corrugated board. A problem in the manufacturing of corrugated board is when the moisture contents in the different layers are out of balance. Corrugated board is often considered to be the packaging material of the future.

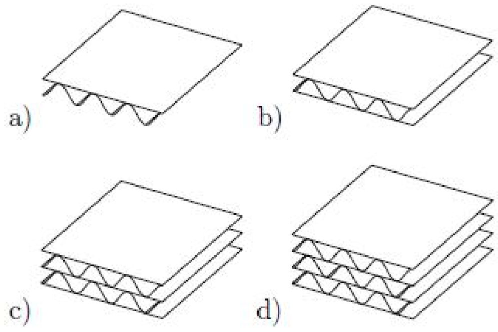


Figure 2.1 Types of corrugated board a) Single face b) Single wall c) Double wall. d) Triple wall.

Then the corrugated board can deform in a buckling shape or as a dip in the facings between the corrugations. These phenomena are called warp and washboard respectively.

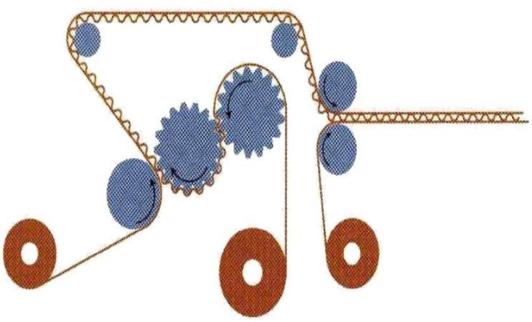


Figure 2.2: The manufacturing of a single wall corrugated board.

2.1 Advantages and Disadvantages

- Low weight.
- Saves money when transporting.
- Can be entirely customized for the purpose.
- It is strong and stiff compared to its weight.
- Easy to handle.
- Easy to print.
- Fully recyclable.
- Very sensitive to humidity.

3.0 LITERATURE REVIEW

Laminated paperboard is often used as a packaging material for products such as toys, tea and frozen foods. To make the paperboard packages appealing for consumers, the fold lines must be both neat and undamaged.

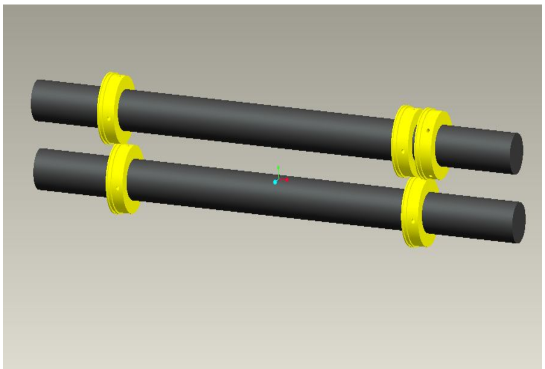
The quality of the folds depends on two converting processes: the manufacture of fold lines (creasing) and the subsequent folding. A good crease contains some delamination, initiated during creasing, to reduce the bending stiffness and to prevent the board from breaking during folding. [1]

Paperboard is a widely used material in industrial processes, in particular for packaging purposes. Packages are obtained through a forming process, in which a flat laminated sheet is converted into the final 3-D solid. In the package forming process, it is common practice to score the paperboard laminate with crease lines, in order to obtain folds with sharp edges and to minimize the initiation and propagation of flaws during the subsequent folding procedures [2]

The main purpose of the creasing operation is to introduce damage in the paperboard to locally reduce its bending stiffness. During loading it therefore important that the paperboard easily delaminates between its plies since this reduces the bending stiffness during folding. Moreover, the plies should internally be able to deform plastically in shear. [3]

4.0 CAD Modeling

The essential difference between Pro/ENGINEER and traditional CAD systems is that models created in Pro/ENGINEER exist as three-dimensional solids. Other 3-D modelers represent only the surface boundaries of the model. These models are the complete solid. This not only facilitates the creation of realistic geometry, but also allows for accurate model calculations, such as those for mass properties.



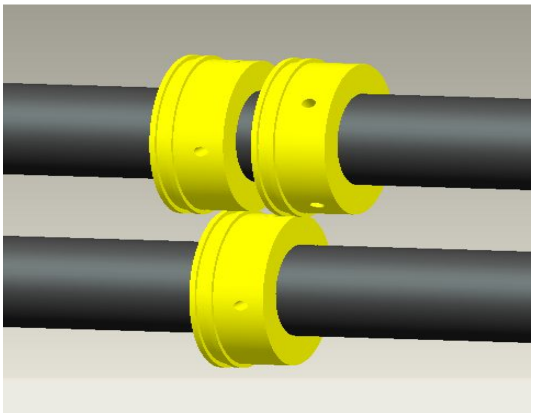


Figure 4.1 CAD model of machine

4.2 FEATURE-BASED MODELING

We created models in Pro/ENGINEER by building features. These features have intelligence, in that they contain knowledge of their environment and adapt predictably to change. Each feature asks the user for specific information based on the feature type. For example, a hole has a diameter, depth, and placement, while a round has a radius and edges to round.

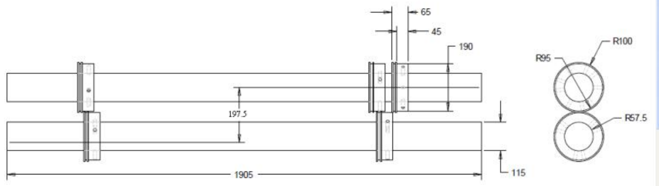


Figure 4.2 Drafting of machine components

4.3 COMBINING FEATURES INTO PARTS

The various types of software features serve as building blocks in the progressive creation of solid parts. Certain features, by necessity, precede others in the design process. The features that follow rely on the previously defined features for dimensional and geometric references. The progressive design of features can create relationships between features already in the design and subsequent features in the design that reference them. The following figure illustrates the progressive design of features.

5.0 FEM INTRODUCTION

The finite element method (FEM), sometimes referred to as finite element analysis (FEA), is a computational technique used to obtain approximate solutions of boundary value problems in engineering. Simply stated, a boundary value problem is a mathematical problem in which one or more dependent variables must satisfy a differential equation everywhere within a known domain of independent variables and satisfy specific conditions on the boundary of the domain. Boundary value problems are also sometimes called field problems. The field is the domain of interest and most often represents a physical structure.

The field variables are the dependent variables of interest governed by the differential equation. The boundary conditions are the specified values of the field variables (or related variables such as derivatives) on the boundaries of the field. Depending on the type of physical problem being analyzed, the field variables may include physical displacement, temperature, heat flux, and fluid velocity to name only a few.

6.0 CONCLUSION

The present work will focus mainly to optimize the production rate of available creasing machine with same boundary condition of input and raw material. The Fem testing can be useful to test the failures and can help in the design of new system. The work is under process and expected output is in terms of production rate of corrugated sheets/hr/shift.

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