11th International Research/Expert Conference
"Trends in the Development of Machinery and Associated Technology"
TMT 2007, Hammamet, Tunisia, 05-09 September, 2007.

DESIGN PARAMETER OPTIMISATION AND COMPUTER-AIDED SIMULATION OF BELT CONVEYORS

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ABSTRACT
Belt conveyors are widely used for carrying loads to long distance haulage in the industrial plants. The aim of this study is examining the design parameters of belt conveyors such as the angle of belt groove, the wrap angle of belt and the coefficient of friction which are acting on the belt tension forces and considering various belt drive systems and their optimization. In this study, the conveyor simulation program is introduced and the belt tension forces according to design parameters are given.
Keywords: conveyor belt, simulation, design parameters

1. INTRODUCTION

Materials handling is one of the important factors affecting the industrial management at the industrial plants. Belt conveyors provide the most sufficient materials handling due to their specifications. Belt conveyors are the most common-used transportation machines as a result of their ability for load carrying to long distances, carrying power, simple design and safe service. There are a lot of solutions at the belt conveyor design due to the variation of structure and the creation of designers. Computer simulation is very useful to get a quick result at the design which is appropriate for the service and using conditions. The aim of this work is to explore the parameters affecting the belt tension forces and to compare the results for different drives.

2. BELT TENSION FORCE ANALYSIS SOFTWARE

The required values at the simulation software as seen at the Fig.1 as a flowchart which is prepared by using th modular structure principles are managed with catalogues and represented with monitor options for designers. Belt tension forces can be obtained as a result of values chosen interactively. At the first step of simulation software, materials to handle and conveyor capacity are chosen as entrance values. Angle of groove of belt conveyor length, belt material and coefficient of friction are chosen as standart values. In addition, diameters of up and down rollers and the distance between these rollers are also chosen as entrance values by the designer.

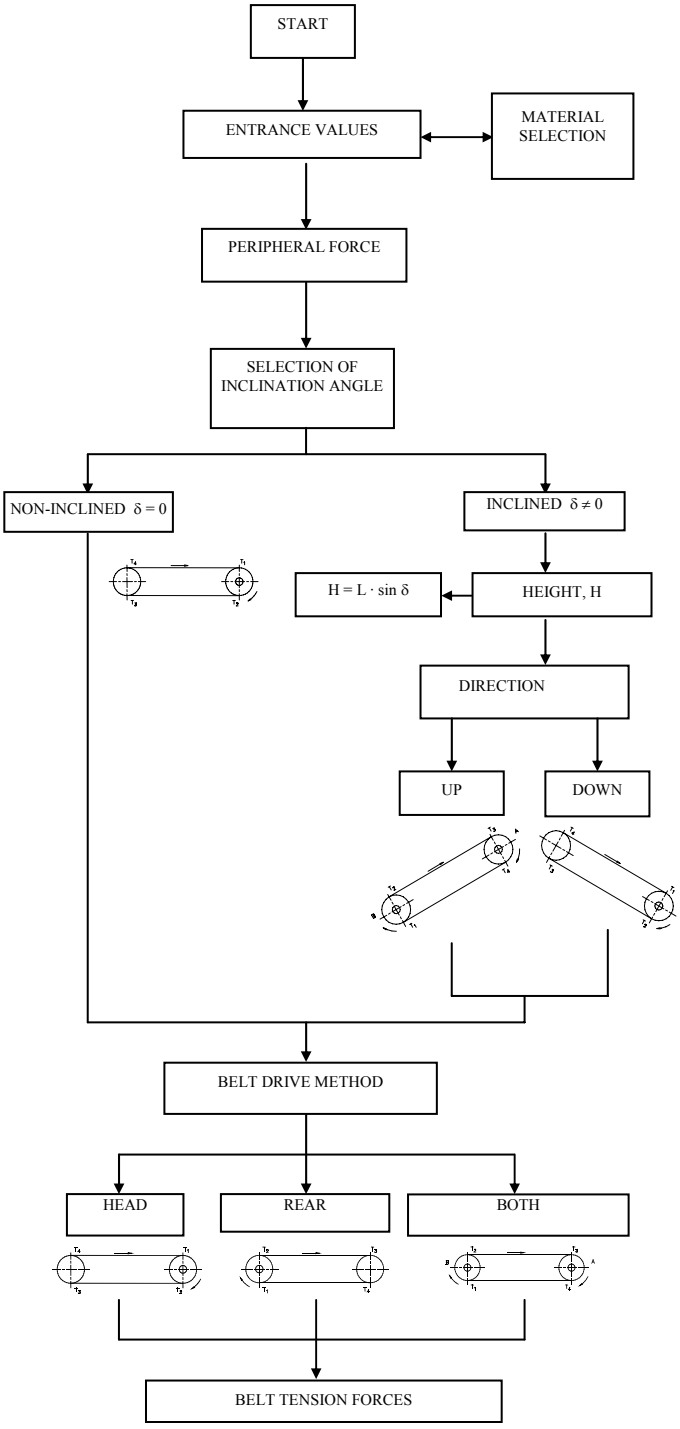

Figure 1. Belt Simulation Software Flowchart

After obtaining the peripheral force of belt, belt inclination is chosen and the height between two pulleys is calculated. Belt drive method is chosen from three options. These are the drive from head, from rear and both. The peripheral forces at the drive method from both rear and head are seperated equal for these two drives and belt tension forces are obtained by the simulation software. Fig. 2 shows us the variation of belt tension force according to belt wrap angle at diffrent types of drive methods of inclined and non-inclined belt conveyors. Head driven is the most suitable design for non-inclined belt conveyors. On the other hand, down – rear driven and up – head driven drive types are the most suitable design for inclined belt conveyors. Fig. 3 shows us the effects of coefficient of

friction for different types of belt conveyor drive methods on belt tension force. The values between 0.3 and 0.4 are obtained as optimum values for any types of drive.

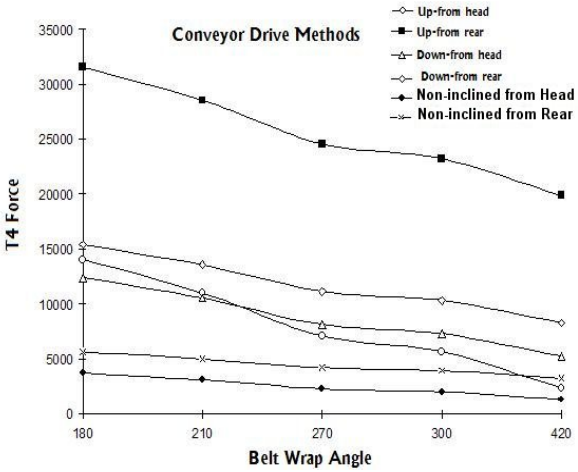

Figure 2. The variation of belt tension force according to belt wrap angle

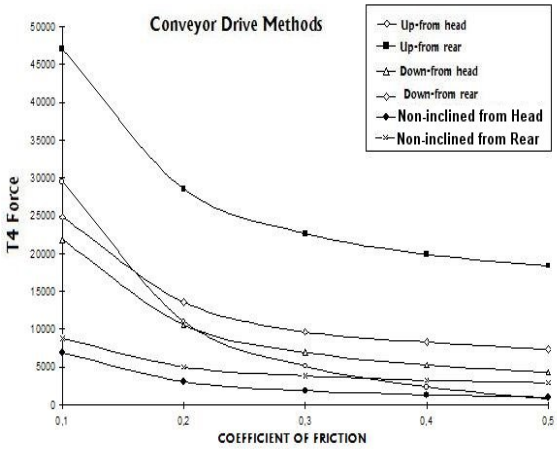

Figure 3. The effects of coefficient of friction for different types of belt conveyor drive methods on belt tension force

Fig. 4 shows us the variation of belt tension force according to conveyor length for diffrent types of drive methods used at belt conveyors. Belt tension force is not too much up to 100 meters of conveyor length, but belt tension force increases suddenly more than 100 meters.

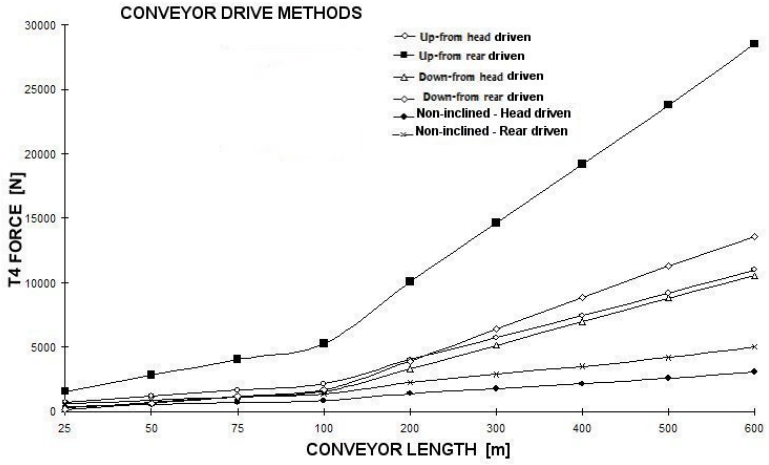

Figure 4. The variation of belt tension force according to conveyor length

Fig. 5 shows us the variation of belt tension force according to angle of groove with different wrap angles for head driven. When different wrap angles are applied, tension force does not change significantly between 20 and 45 degrees angle of grooves, but tension force decreases when wrap angle increases at the head driven method for non-inclined belt conveyors. We can see almost the same trend at the head driven for up and down and the tension force increases.

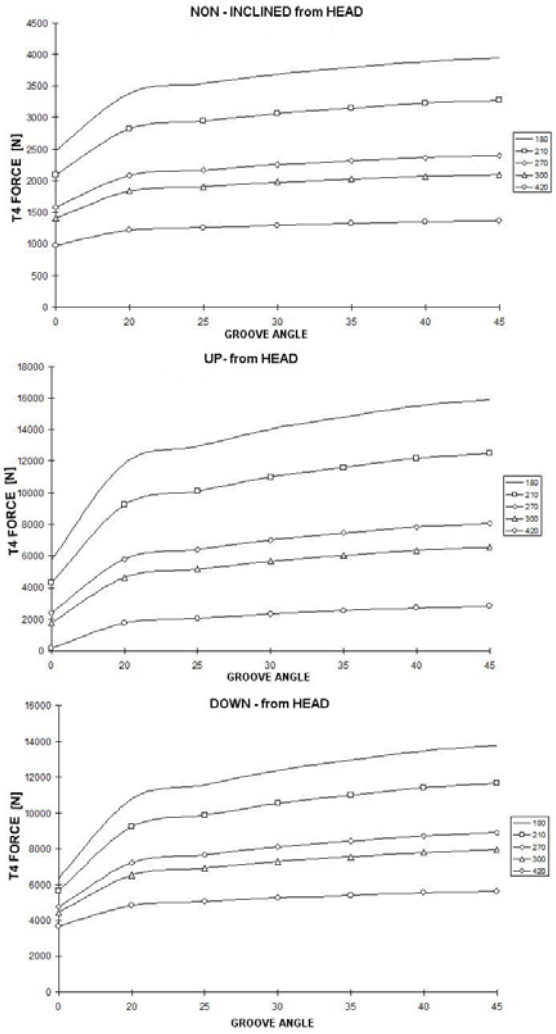

Figure 5. The variation of belt tension force according to angle of groove with different wrap angles for head driven

3. CONCLUSION

Selection of appropriate structure of belt conveyors, which is necessary for industrial plants, is very important especially for long distance materials handling. When wrap angle of belt increases, tension forces decreases for three cases. Tension forces increase linear and not too much up to 100 meters of conveyor length. On the other hand, they increase significantly more than 100 meters of conveyor length.

4. REFERENCES

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