

Summary (English)

Passenger conveyors can be driven by multiple drives. These drives have to deal with variable loads. Controlling these drives at the optimum way, both for travelling comfort as well as for the system conditions, is a very important issue. Reducing power consumption by controlling the speed can reduce operating costs and provide energy savings.

The main aims of this literature study are to investigate what control techniques for systems with multiple drives are available, to define if there are some techniques or combination of techniques suitable to control a passenger conveyor and to investigate the possibilities to reduce power consumption by using one of the techniques (or combination of techniques) found.

To get the useful information about controlling a multiple drive system, a search through the literature is done. The results found are processed and final conclusions are made. Recommendations on possible control techniques to develop the multiple drives in a passenger conveyor are given.

For the drives a DC permanent magnet motor, an AC synchronous motor or an AC induction motor can be used. The squirrel cage induction motor and the wound rotor induction motor are the frequently used induction motors. The different types of motors have several advantages and disadvantages. These are given in the literature study. The choice of motor depends strongly on these pros and cons of the motors.

The control techniques for systems with multiple drives are divided in three groups: speed and torque control, synchronization, and tension control. Within these groups different control methods are found. Scalar control, vector control, direct torque control and the cycloconverter are the used techniques in speed and torque control. Couplings are also considered in this group because the coupling of the multi-motor drives in the process dictates the coordinated control. These can be classified as the rigid coupling, the resilient coupling, the viscous damping coupling, the fluid coupling and mechanical uncoupled drives. For synchronization the master slave technique, cross coupling technique, bi-axial cross-coupled control method, electronic virtual line shafting technique and the relative coupling strategy are considered. The speed difference indirect tension control method, the speed with torque limit tension indirect control, the tension control by utilizing tension sensors and the sensorless tension control method are examples of tension control.

Energy saving methods are found and given by variable speed drives and the slip energy recovery technique.

Some previous investigation about drives and control methods is already done. Either some control methods are compared or a control method is tested and evaluated.

For implementing a long passenger conveyor with multiple drives the requirements to be fulfilled are tension control, speed control and energy efficiency. These control methods must operate at the optimum way, because passenger safety and travel comfort are important factors. After investigating different kind of control methods during this literature study, some recommendations for realizing a long passenger conveyor system are given. The AC squirrel cage induction motor is the most suitable motor for the drives. For speed control the electronic virtual line shafting technique is very useful. Applying direct torque control will also give a good performance of the system. Due to load changes on the system and the constant adjustments of motor speed, couplings are needed in the system between motor and shaft. Variable speed drives are the best option to reduce power consumption of a passenger conveyor system. Variable speed drives can also enhance machine and motor life and reduce maintenance.