

# Brückner

## The Art of Stretching.

**Plastic packaging, cigarette wrappers, video tapes, or capacitors for the electronics industry – the use of plastic film is extremely widespread. We come into direct or indirect contact with various types of plastic film every day. But most of us are not aware of the complexity of manufacturing these only micrometer thin products.**

tented for simultaneous film stretching machines, providing the foundation for producing machines based on this solution. The limited yield of mechanical solutions led to the development of LISIM® technology, which has a purely electrical configuration using linear motors. The same drive principle used on the Transrapid magnetic levitation train is applied here as well. The combination of flexible computer-supported control technology and mechanically independent drives allows a new level of freedom to be obtained when manufacturing high quality films.

At Brueckner Maschinenbau GmbH in Siegesdorf, Bavaria, you can see just how much work and know-how are required to manufacture some of the most common things in life. With 450 employees, the company offers film production systems and is the world leader in computer controlled film stretching lines. Plastic film is stretched with this type of system. In their own technology center for film manufacturing, Brueckner has developed new and innovative methods of transforming raw plastic granulate into finished film.

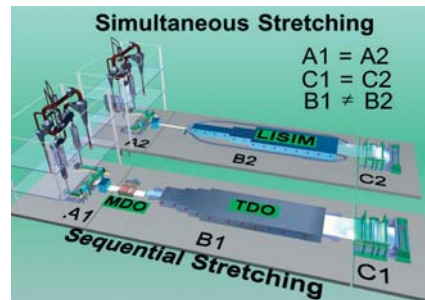
Several hundred electronically coupled linear motors operate in the LISIM® simultaneous film stretching machine, using drives which were specially developed for Brueckner. The motors move 750 clips on each of the two diverging rails. At the machine inlet, the raw film is gripped in this way. During the machine cycle, the clips increase in speed and move out on the rails which stretches the film lengthwise as well as laterally. At the machine outlet, the clips release the film. The clips and motors are in an environment which is heated up to 250°C. However, the motors are only rated for operating temperatures between 150 and 160°C – a heavy demand on the tempering for the machine and components.

An advantage of the procedure for the film stretching line is that it uses the raw material to its fullest. The film types created have a very low base weight and are mostly used as packaging material or for technical products such as foil capacitors or video tape. With the film stretching line, the raw material coming out of a plastic extruder is stretched in an oven until the desired film dimensions are reached. Traditional systems first stretched plastic lengthwise over rolls spinning at different speeds and then stretched it laterally using clips and chains.

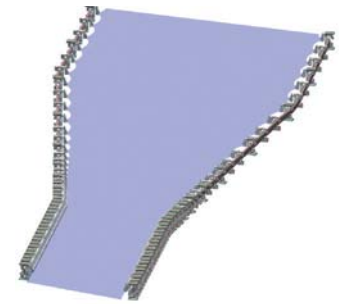
Possible thermal motor failures must be recognized and handled in time in order to prevent production of faulty material and minimize machine downtime. In addition to a certain amount of component redundancy, which allows the replacement of single failures to be put off until the next maintenance period, a great deal has been invested in early error detection. The motors have more than 1,000 temperature measurement



Film from Brueckner can be used for a wide range of products: from packaging and cigarette wrappers to video tape and capacitors in the electrical industry.



Plastic is first stretched lengthwise before being stretched laterally in the sequential film line. LISIM's technique can handle both dimensions at the same time.



points so that over-temperatures can be recognized and suitable countermeasures can be carried out. When first being calculated, each measurement point had a cost of approx. 200 €, which would have resulted in a total cost of around 200,000 € for temperature measurement. Working together with B&R, the implementation of optimized remote I/O systems and ETHERNET Powerlink networking reduced the cost to 25 € per measurement point. That equals a cost reduction of more than 87%. The bandwidth of ETHERNET Powerlink allows large amounts of temperature data to be



LISIM clips picking up PET film. The temperatures of individual clip rolls and bearings are constantly monitored to prevent damage.

transferred efficiently to a CP360 CPU. The long distances on the machine can be easily handled with Ethernet technology, which would not have been possible with some other fieldbus systems. The CP360 evaluates the temperature values and warning thresholds and informs the operator of any inconsistencies.

The LISIM® machine has another interesting safety measure in addition to the extensive monitoring of the linear motors: The temperature of the individual

rollers and bearings in the clips is checked continuously in order to recognize bearing damage in advance and correct it during the next maintenance period. A broken bearing could cause an enormous amount of damage to the guide rails, which would result in the machine being out of commission. Therefore, the research and development department at Brueckner developed an ingenious mathematical model for the clip bearings that allows problems to be recognized in advance based on a thermal profile. When using 1500 clips with eight bearings each on two rails, the expenditure for risk minimization surely pays off. The temperature of each bearing is measured with an infrared camera during each cycle. An additional CP360 CPU from the B&R 2005 family collects the data, analyzes the data pool and sends warnings if approaching critical temperature ranges. The operator knows exactly which clip needs to be changed during the next maintenance period so that damage to the system can be prevented.

In addition to these special measurement and monitoring systems, the LISIM® system also uses many conventional control techniques for open and closed loop control of heaters, fans, protective switches, operating buttons, lamps and drives. Depending on the size of the system, a total of three to six CP360 CPUs with corresponding peripheral devices handle the independent control of the individual sections of the system. A process control system is superimposed which allows the system operator to monitor and access the various procedures. LISIM® film stretching systems are built with widths up to 6.6 meters and reach throughputs of up to 3,500 kg/h at speeds of up to 350 m/min. Every system is unique and configured according to the customer's individual requirements. The spectrum

ranges from pure film manufacturers who purchase the complete plastic know-how and the systems from Brueckner as turnkey solutions to experts who implement their own procedures on Brueckner systems. Top companies like DuPont, 3M, and Bimo manufacture film using Brueckner's LISIM simultaneous film stretching machine.

B&R systems were used by Brueckner in standard systems even before LISIM® technology was implemented. Years ago, they were searching for controllers that can be programmed using high level languages. Long before the IEC 61131 standard for programming languages in automation was developed, B&R allowed programming of its control systems in C, which was in line with the Brueckner developers' needs. In the meantime, IEC 61131 has become an established standard and Brueckner will move away from using C. This is not a problem because of the wide range of languages supported by B&R systems. This flexibility and potential for innovation is definitely appreciated by Brueckner. 