

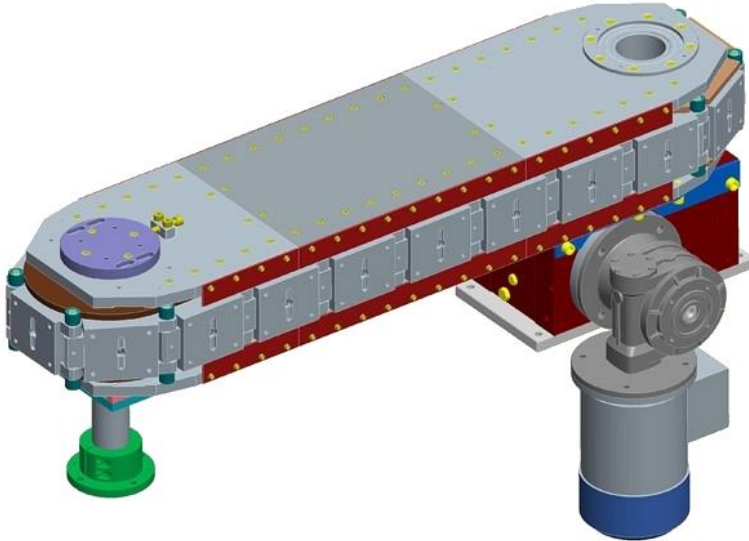
Flexible transportation systems

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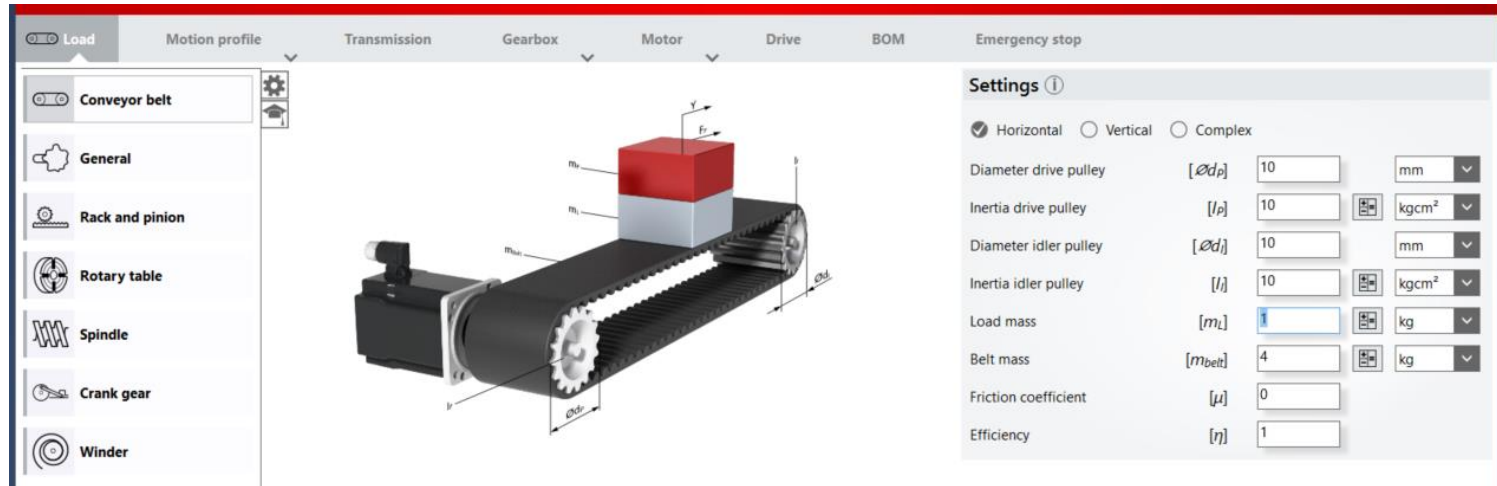
BECKHOFF

Transportation systems – Standard solution



- Motor (asynchronous or brushless)
- Gearbox
- Pallets with fixed steps
- Station to station movements

Transportation systems – Standard solution



Settings ⓘ

- Horizontal Vertical Complex
- Diameter drive pulley [$\varnothing d_p$] 10 mm
- Inertia drive pulley [I_p] 10 kgcm²
- Diameter idler pulley [$\varnothing d_i$] 10 mm
- Inertia idler pulley [I_i] 10 kgcm²
- Load mass [m_L] 1 kg
- Belt mass [m_{belt}] 4 kg
- Friction coefficient [μ] 0
- Efficiency [η] 1

Simple mathematical models



Transportation systems – Standard solution

Motion profile definition :

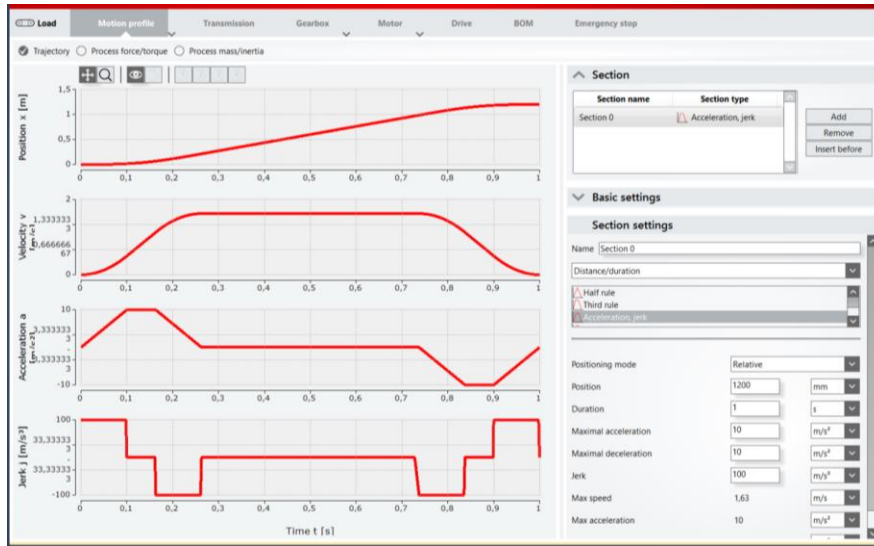
- Few calculation needed
- Limited interaction between mechanical and electrical components

Application field:

- Packaging
- Assembly
- Pharmaceutical

Transportation systems – Standard solution

Define motion profile:



- Dynamics (position, velocity, acceleration)
- Center of gravity, Inertia, material
- Cycle profile (movement time, rest time)



Transportation systems – Standard solution

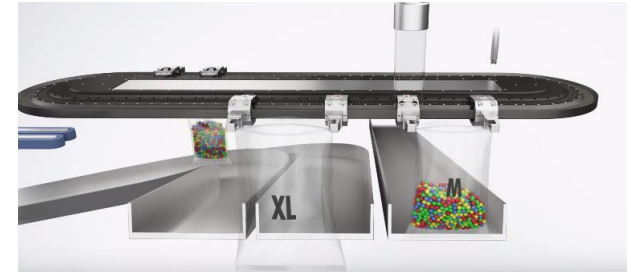
- Long downtimes due to changeovers
- Not flexible
- Maintenance

Transportation systems – Flexible solution



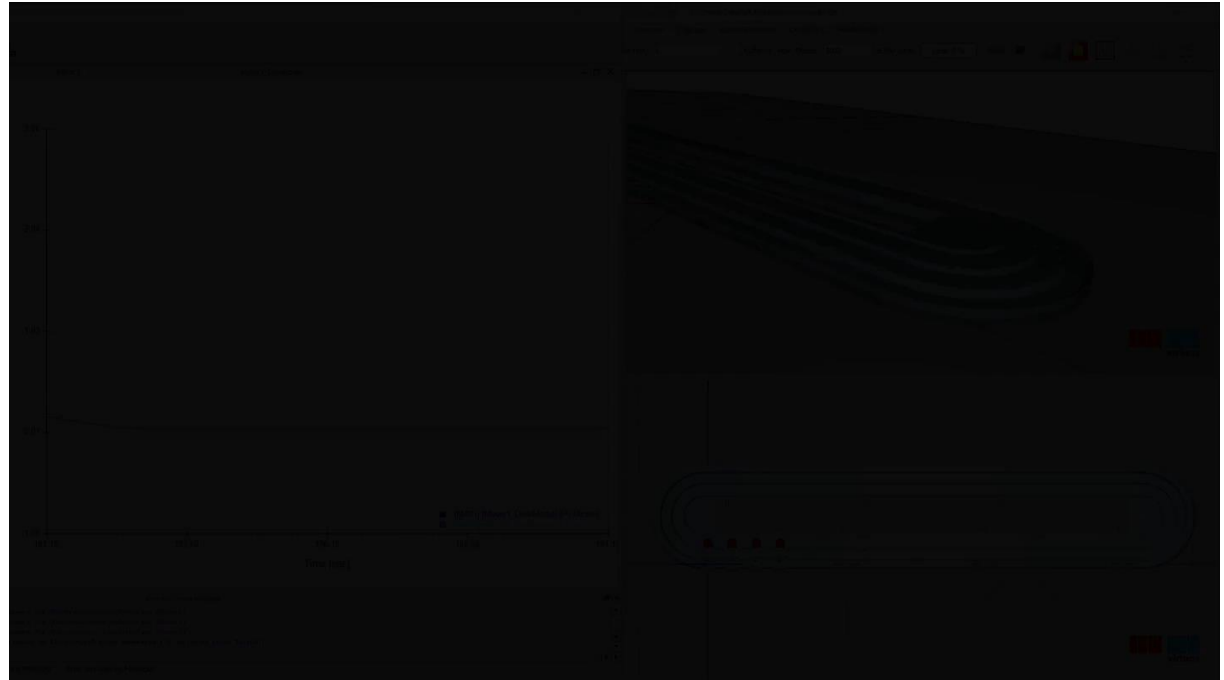
Transportation systems – Flexible solution

- Changeovers by recipe
 - Customization of production
- Extreme flexibility «on the run»
 - Flexible flow according to working station status
- Low maintenance
 - No moving mechanical parts, only bearings on rail



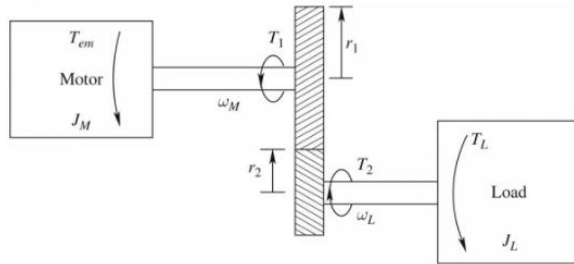
Transportation systems – Flexible solution

- Complex profile
- Contemporaneity
- Strong interaction between mechanical, electronic and even programming part
- Mechatronic skills are required



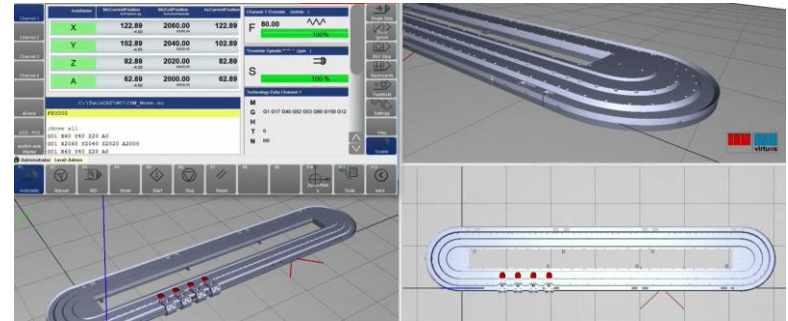
Transportation systems – Kinematic analysis

Standard systems



1. Standard mathematical model
2. Standard dynamic profile

Flexible systems



1. Improved model required
2. Flexible dynamic profile to optimize speed, current consumption, position profile
3. Improved tools and skills