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Advantages and Useabilities of the Electrorheological (ER) Damping Systems made by FLUDICON

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1. Introducing FLUDICON and the ER-Technology

2. ER-Applications

3. Discussions
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Tasks of FLUDICON

Development, production and sales of industrial products which bases on the Electro Rheological effect

History of FLUDICON

1995  Starting research in ER technology at Carl Schenck AG Darmstadt

2001  Founding of Fludicon (spin off of the Dürr/Schenck Group)

2003  First ER applications and optimizations of the ER fluid

2007  Development of the *RheDamp* Series for industrial applications started

2009 … Sales of RheDamp Series started. Development of ER dampers for automotive projects (LCV and tuning).
Cooperation between Bansbach and Fludicon started in 2008. The contents of cooperation are ...

**Manufacturing**

Bansbach is manufacturing and assembling the Fludicon ER-Damper.

**Sales**

Bansbach sales the ER dampers, amplifiers and the fluid.

**Application**

Fludicon supports Bansbach for applications of the ER technology.
Possibilities in industrial applications...

- Damping systems (various damping and remote damping control)
- Controlling systems
- Positionizing
- Reducing oscillations at typical frequencies
- Avoid vibrations
- ...

Benefits of the ER-Technology
FLUDICON is innovation leader in electro-rheological-fluids and development of ER-damping-systems

Complete knowledge in ER systems:
- Development, design and application (mechanics, hydraulics, electronics and software)
- Own fluid development and production
- Consulting

3 Locations in Germany:
- Darmstadt 25 employees; head quarter
- Würzburg 4 employees; fluid development
- Hennigsdorf 4 employees; electronic development
Products of FLUDICON

- Damping Systems (RheDamp®)
- ER-Fluid (RheOil®)
- Controller / Amplifier (DampCon®, RheCon®)
- Software / Hardware
- Special solutions
**Principle:** A moving piston leads to a flow through the ER ring valve. This flow can be reduced by a supplied voltage. The result is an increased force.
- RheDamps offers a wide range between soft and hard damping
- Standard dampers only offers one curve (e.g. oil brakes)
Electrorheological fluids are dispersions consisting of an oil (mineral- or silicon oil) and solid polymere particles (approx. 50%)
Electro-Rheological-Effect

ER-Fluid coloured

without electrical field

with electrical field
Electro-Rheological-Effect

Elektrisches Feld: aus

Elektrode +

Elektrode -
Properties of ER-Dampfer Systems

RheDamp® and eRide®

Continuous Control - Wide range between soft and hard damper characteristics!

High Dynamics - Changing the damper force in a few milliseconds!

Efficiency - Low Power consumption (2…20 W) at high efficiencies (>80%)!

Acoustics - No throttle effects (no turbulence) – absolutely noiseless!

Durability of Damper - Very robust damper system without moving valve elements!

Durability of Fluid - Electrorheological Fluid gets no damage by the ER effect!
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Industrial Applications

- Furniture Industry
- Conveyor Technology
- Machine Suspensions
- Automation Handling
- Centrifuges
- Maschines Paper and Foil Industry
- Agricultural Machines
- Textile Machines
- Metal Forming Machines
- Machines for Production

RheDamp®
Reducing Vibrations: „Machine-Suspensions with ER-Dampers“
Machine Suspension at a Servohydraulic Press

40t Servohydraulic Press

8x ER-RheDamp
Frequency Response of a Machine Suspension

Vertical Acceleration

- ER-RheDamp at 0 kV
- conventional suspension
- ER-RheDamp at 4 kV

Speed
Benefits ER-Machine Suspensions

- Increasing Damping rate only if its necessary (optimize the isolation behavior for high frequencies)
- Reducing oscillations, e.g. by a Skyhook-Control algorithm

**Benefits for the manufacturer:**
- Increase the process efficiencies
- Increase quality of products
- Increase the durability of the machine
Controlling Pneumatic Actuators
„The ER-Drill System“
Controlling Pneumatic Actuators

**Problem:**
Bad accuracy of pneumatic actuators;
High complexity and costs for reaching the needed accuracy

**Solution:**
Combine a pneumatic actuator with an ER-RheDamp
... Suhner ER-drill System
Before the Suhner ER-Drill was invented …

… following adjustments were necessary:

1. Adjust the drilling dept
2. Adjust the rapid stroke limit
3. Adjust the drilling velocity by an oil-brake
Controlling the drill process with constant velocity without mechanical adjustments

Example: Drilling through different materials

Suhner, BEM 12 ERdrill
Benefits Suhner ERdrill System

- No Adjustment of an oil-brake
- No Adjustment of the drilling dept
- Controlling the drill process (const. Velocity)

→ Accuracy of NC-machines at economic costs of pneumatics

Suhner, BEM 12 ERdrill

Control Unit
Using ER-RheDamp for „End-of-stroke Damping“
Aims of „End-of-Stroke Damping“

- Control the velocity of moved masses at end-of-stroke
- Avoid hard impacts for increasing the durability of the machine and ensure the needed quality of production

Applications:
- Any kind of moved masses with high accelerations
- Transportation Industries
- Open- and Close-Operations of machine housings
Closing-Operation of a machine housing (picture)
1. RheDamp without control (0 kV)  

2. RheDamp with control (max. 4 kV)  

- Significant improvements at velocity curve with RheDamp-Control  
- Simple proportional control strategy is enough:  
  - small velocity → small damping rate  
  - high velocity → high damping rate
Benefits „End-of-stroke Damping“ with RheDamp

- No manual Adjustment of an oil-brake
  (Remote Control of the damping rate)

- Controlling the velocity of movements
  (using a sensor for displacement and a simply control strategy)

- **Benefits for the manufacturer:**
  - Increase the process efficiencies
  - Increase quality of products
  - Increase the durability of manufacturer machines
Possibilities for the ER technology in industrial applications ...

- Damping systems (various damping and remote damping control) ✓
- Controlling systems ✓
- Positionizing ✓
- Reducing oscillations at typical frequencies ✓
- Avoid vibrations ✓
- ...

The **ER-Technology** is an excellent and innovative method for digital control of mechanic, hydraulic or pneumatic systems!
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