

Optimization of control algorithm of MR damper

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ústav
konstruování

Trying is first step to failure

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BUT

7.5.2013

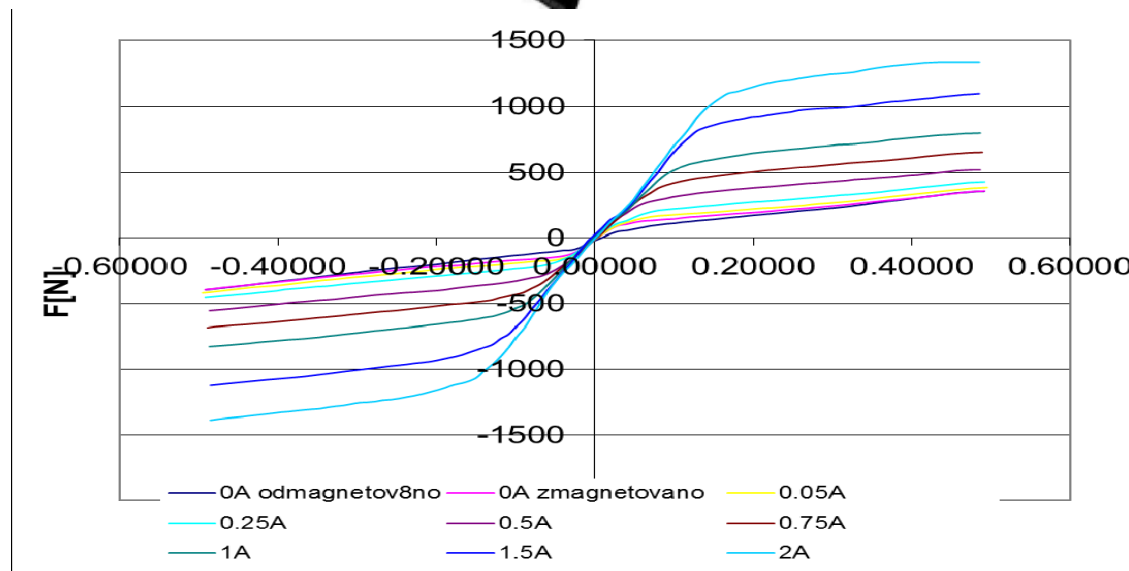
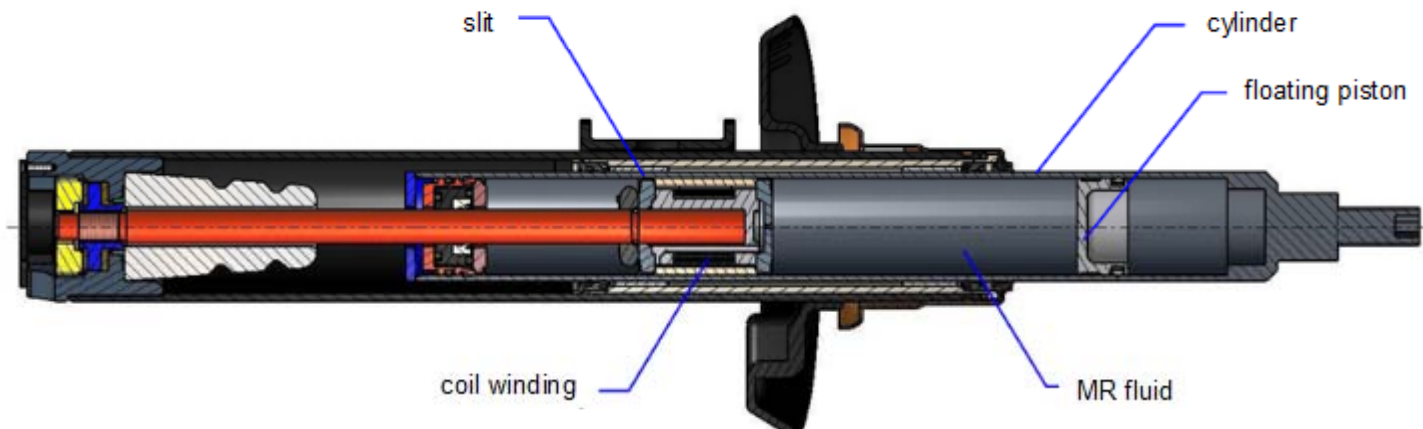
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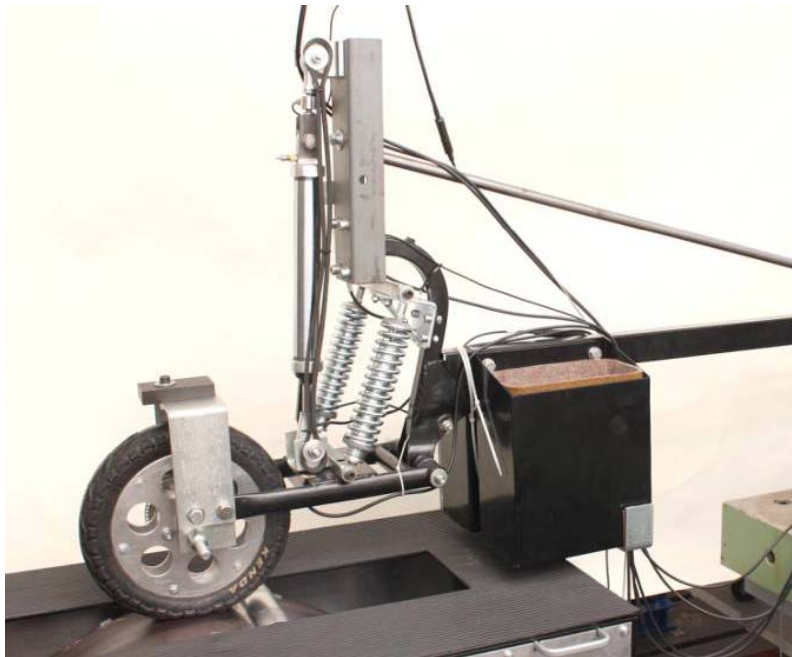
Optimalization of control algorithm of MR damper

MR damper

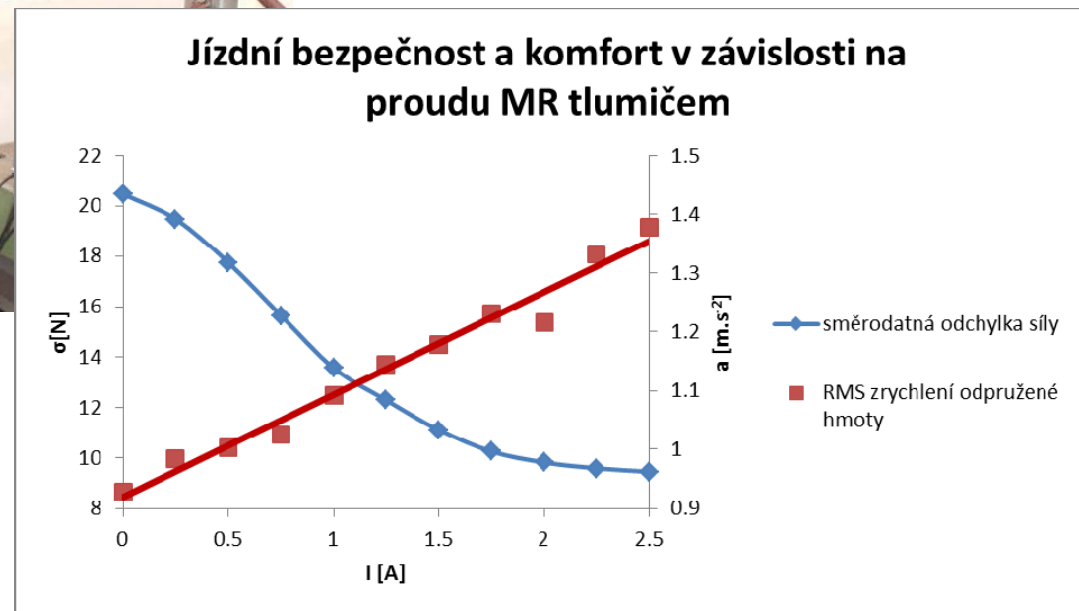


Optimization of control algorithm of MR damper

Passive settings comparison



- Comfort function evaluation – RMS of sprung mass acceleration
- Safety function evaluation – standard deviation of force



Optimization of control algorithm of MR damper

Groundhook algorithm testing

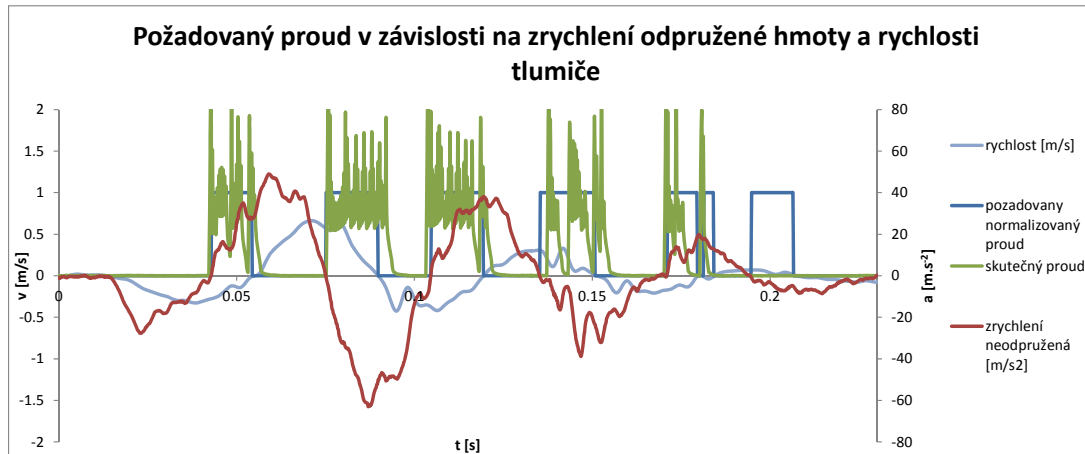


- Safety function improvement
- Algorithm:
 - When the speed of unsprung mass to the ground > 0 and relative speed of sprung and unsprung mass < 0 – maximal force
 - Else minimal force

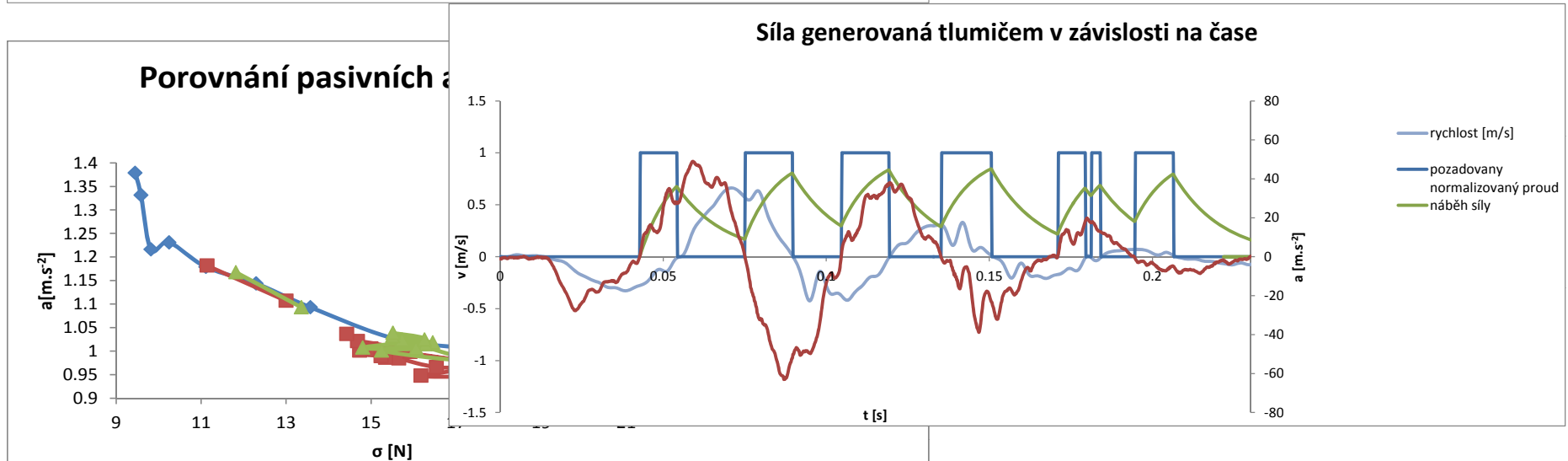


Optimization of control algorithm of MR damper

Groundhook algorithm testing



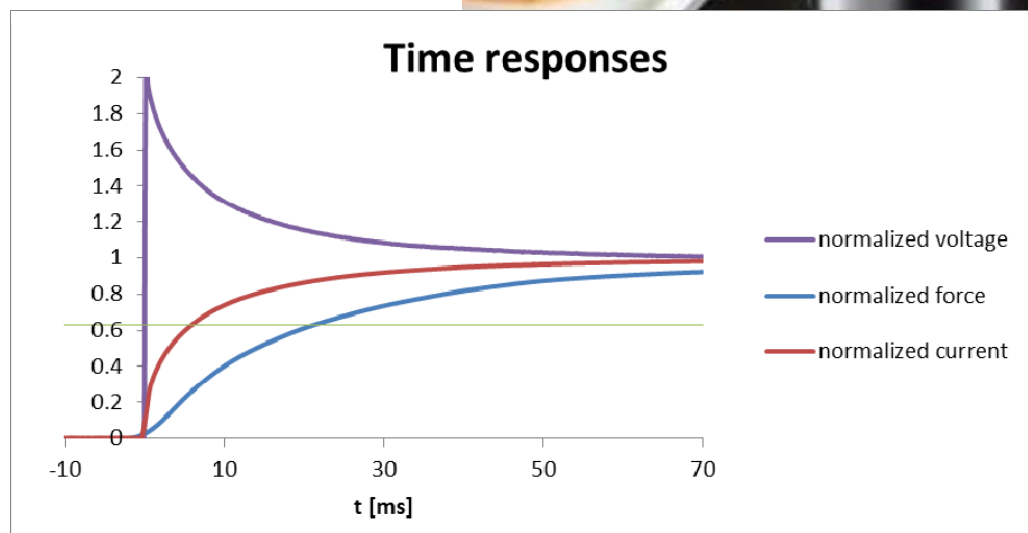
- Current is switched correctly
- Slow semi-active algorithm is better than passive
- Fast semi-active algorithm is same like passive
- Why??



Optimization of control algorithm of MR damper

MR damper response time sources

- MR fluid (up to 1ms)
- Electromagnetic circuit
- Eddy-currents

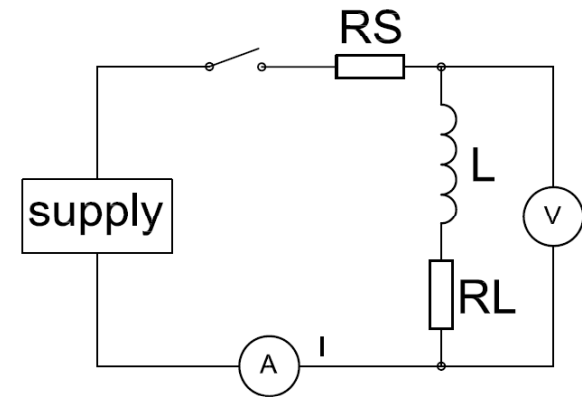


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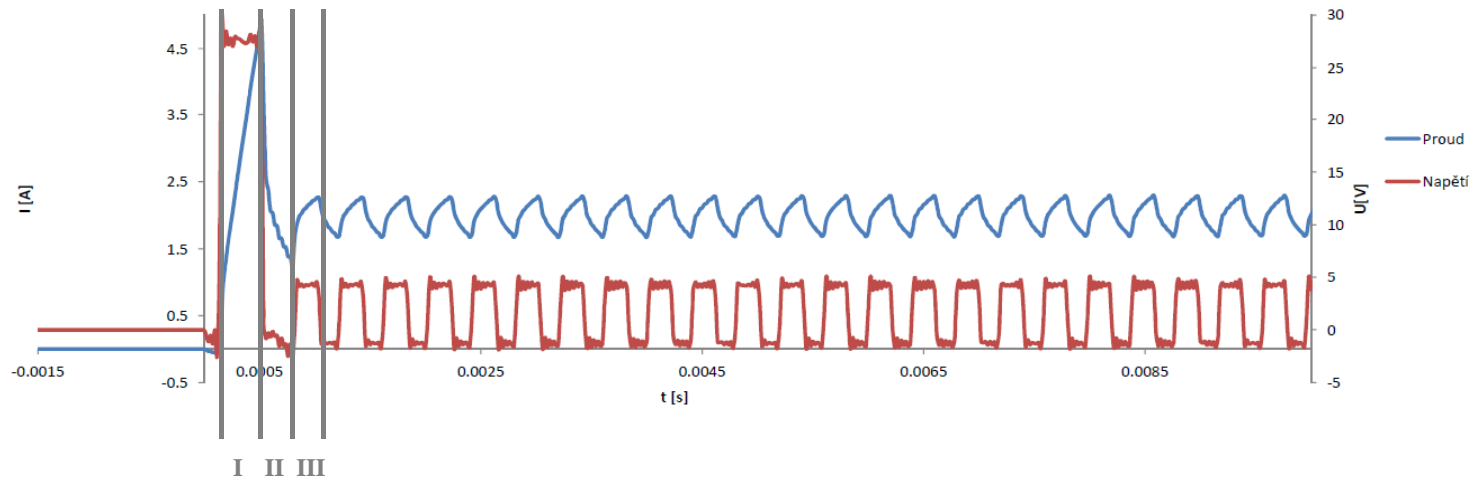
Electromagnetic circuit response time minimization

- Using high voltage until desired current is reached

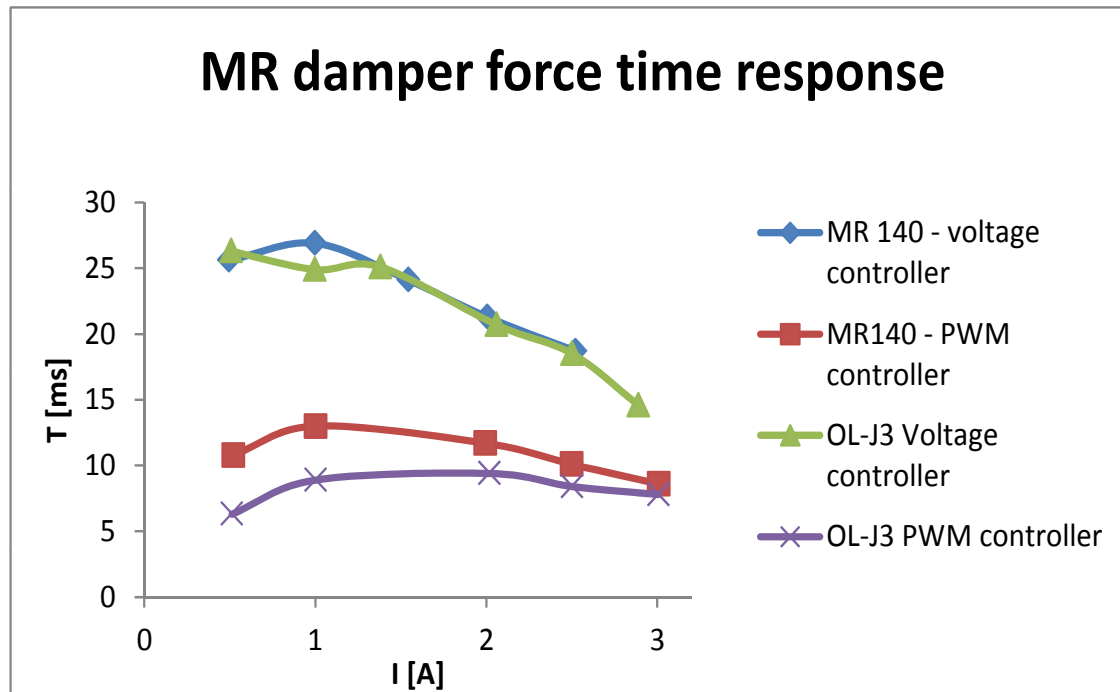
$$i = \frac{1}{L} \int u(t) dt, \quad u(t) = i \cdot R_L \Rightarrow i = \frac{U}{R_L} (1 - e^{-\frac{R_L t}{L}})$$



Průběh napětí a proudu s optimálním řízením



Results – time response of force



- PWM controller significantly reduces overall time response of the MR damper
- The time response of the MR damper is much longer than time response of MR fluid

Eddy-currents in ferrite materials

